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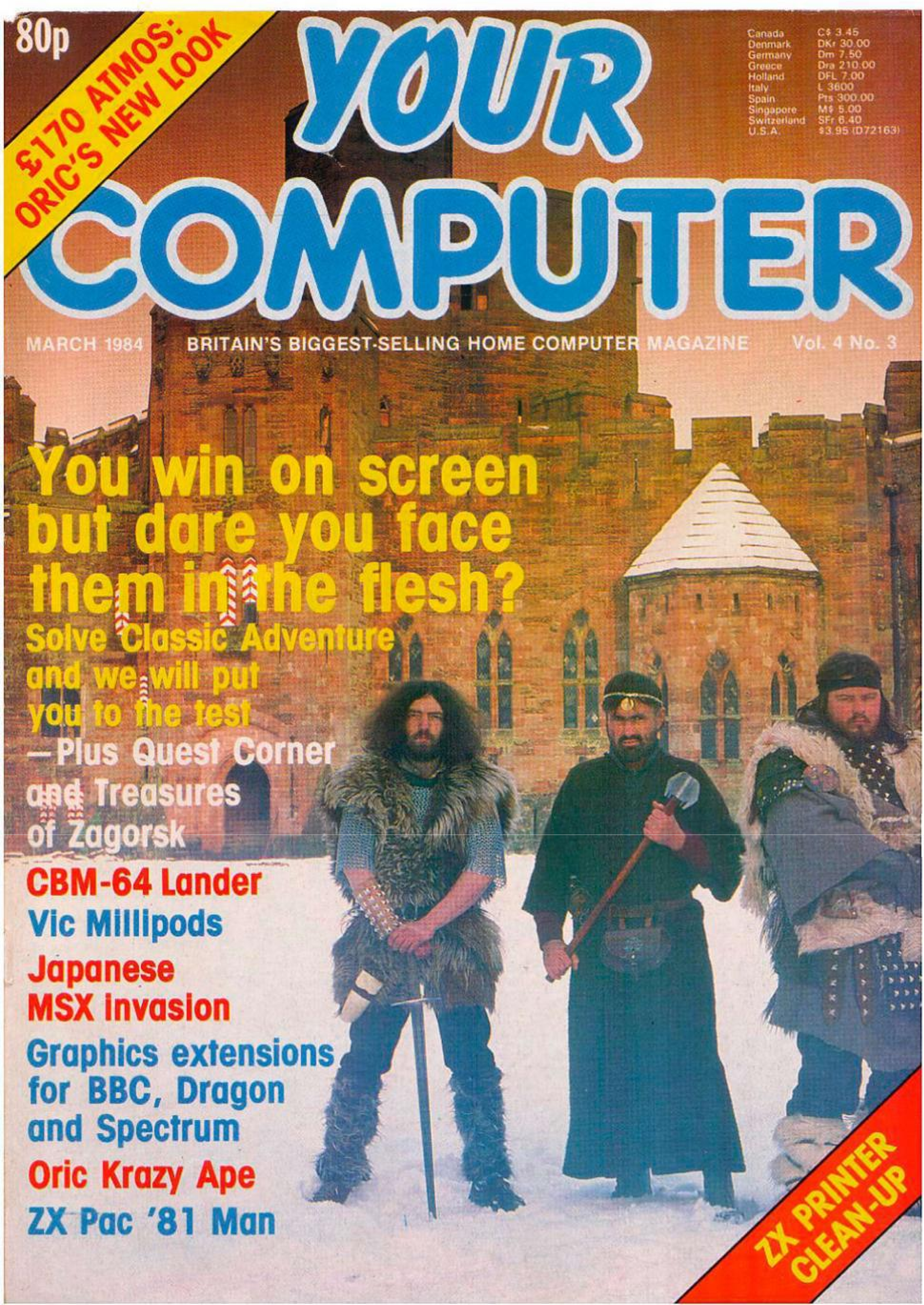
MARCH 1984 BRITAIN'S BIGGEST-SELLING HOME COMPUTER MAGAZINE Vol. 4 No. 3



You win on screen but dare you face them in the flesh?

Solve Classic Adventure and we will put you to the test —Plus Quest Corner and Treasures of Zagorsk

CBM-64 Lander

Vic Millipods

Japanese MSX invasion

Graphics extensions for BBC, Dragon and Spectrum

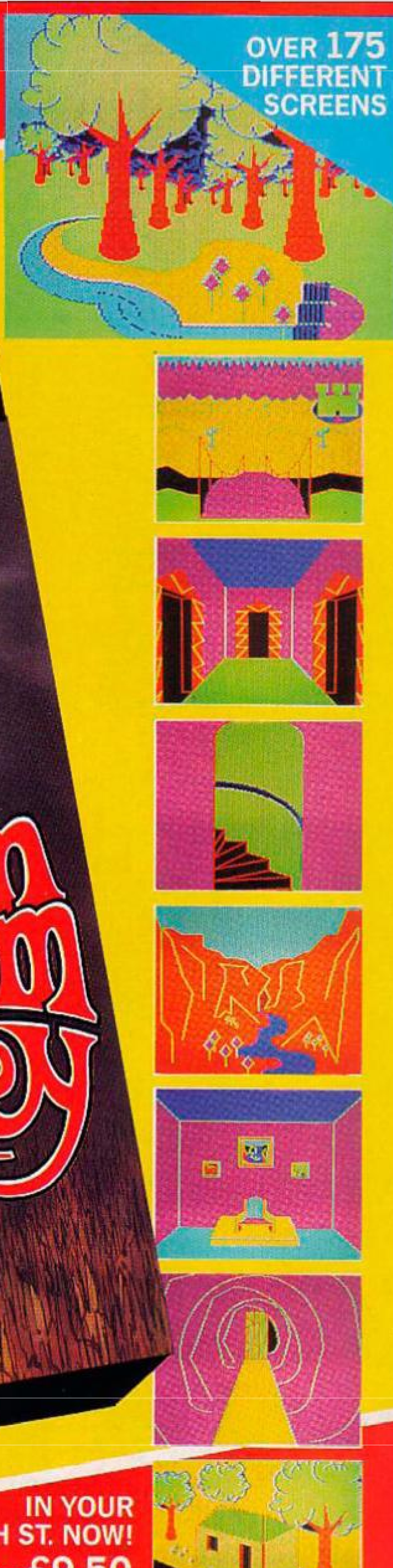
Oric Krazy Ape

ZX Pac '81 Man

ZX PRINTER CLEAN-UP

A RANGE OF QUALITY COMPUTERS AVAILABLE FOR THIS PROGRAM.

Thousands of Commodore 64, Electron and BBC micro users have recently taken a trip into the heart of Twin Kingdom Valley, and none have returned disappointed!
This incredible new program takes adventure games into new, uncharted territory, with a highly complex journey through over 175 different full colour, graphic locations, to test you and your computer to the limit.
Are you brave enough to take the test?



Versions available now for Commodore 64, Electron and BBC Model B.

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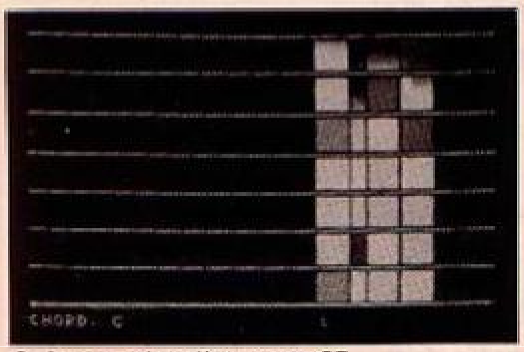
Mulberry House, Canning Place, Liverpool
Dealers contact Matthew Thomas on 051-709 7071

Registered Dealers can order direct from CBS Distribution on 01-960 2155.

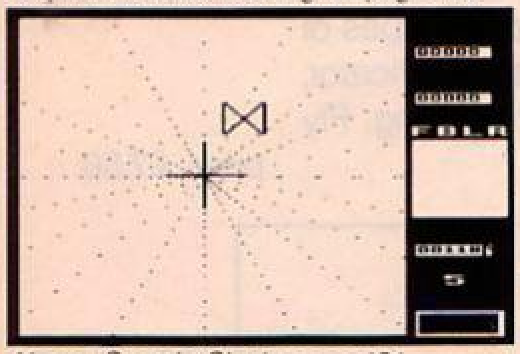
YOUR COMPUTER Contents

MARCH 1984


Software shortlist: page 57.

Commodore Zagorsk: Page 77.

Graphics feature starting on page 114.


Above: Cosmic Clash: page 164.

Cover photograph by Stephen Oliver.

BUG-BYTE SOFTWARE BULLETIN
SPRING 1984
160,000 Copies Printed
Volume 1
Number 1

BUG BROTHER IS WATCHING YOU!

1984 is going to be an interesting and exciting year for the world of home computer software. Last year, a wide range of software of varying quality came on the market, produced by an ever-increasing number of software houses. In 1984, only the best will survive. At Bug-Byte we have 4 years experience in the field – longer than nearly all of our competitors. We are committed to producing software of the highest quality at the right price for a range of the most popular micros. All our products are guaranteed against defects, and are widely available, so look out for the bug.

In the first issue of the bulletin, we hope to give you some insight into the workings of Bug-Byte with all the latest news and promotions.

BORIS THE BEE CAPTURED

The Bug's friend Boris the Bee, the honey gathering star of "Birds & The Bees", has been kidnapped by a swarm of marauding Ants.

Fortunately for Boris his brother Barnabee has heard of his plight and is planning a daring rescue.

CAN BARNABEE BUZZ HIS WAY THROUGH THE ANTS NEST?

CAN HE FIGHT OFF THE HOSTILE ANTS AND THEIR INSECT ACCOMPLICES?

WILL BORIS BEE RESCUED?

Find out in "Antics" (Birds & The Bees 2) only £5.95 from Bug-Byte!

100% Machine Code, smooth and colourful animations and great sound effects!

Available from mid-March.

UPGRADED MANIC MINER FOR CBM 64

A much improved version of our software chart topping best seller, Manic Miner for the Commodore 64 is in an advanced state of development. Many improvements have been made to the original to take advantage of the 64's additional facilities. 'Mattie Goes Mining', as the new version is called, will be available at £7.50 by mid-March.

QUICK BYTE SHOCK HORROR AT HILTON

The luxury and splendour of the Hilton Hotel Grand Ballroom in Park Lane, London provided a suitable venue for a unique occasion on Wednesday 21 December. Two of the oldest and most successful software houses in the industry, Bug-Byte Ltd and Quicksilva Ltd entertained over a hundred of the industry's leading figures to dinner, and startled them by announcing their move into fast food. Many of the assembled luminaries were unsure whether or not to believe their ears as the famous broadcaster and journalist Reginald Bosanquet delivered a speech outlining the two software giants plans to open a chain of Quick Byte fast food restaurants.

"Are we supposed to get the joke now or later", asked John Wood of Ocean.

"What joke" replied John Phillips of Bug-Byte.

Indeed both Bug-Byte and Quicksilva have been remarkably tight-lipped about the whole affair. So, is Quick Byte the fast food for the eighties or just pie in the sky? We must wait and see.

Reginald Bosanquet was called upon to make the presentation of the International Software Society's Artists Awards after dinner. Nearly twenty lucky winners from dozens of nominations

received "Clives", the software industry's very own Oscars. Among the recipients of this supreme accolade were Imagine, Virgin, Interceptor, Home Computing Weekly (and its editor Paul Liptrot).

The awards are the very first presented and are expected to become an annual event.

"Next year it will be bigger and better", said John Phillips, "we hope to raise a substantial amount of money for charity as well as having fun".

So come on all you home computer industry whizz-kids, 1984 could be your year to win a coveted Clive award.

SUCCESS FOR TWIN KINGDOM VALLEY

Bug-Byte's Twin Kingdom Valley by Trevor Hall looks set to become one of the smash hit adventure games of 1984. Officially launched last November the game has already sold in large numbers and is rapidly achieving cult status.

"We knew it would be big" said Bug-Byte's Tony Milner, "but I must say its already exceeded our expectations".

The game features over 175 different screens with full colour graphics and a labyrinthine "plot". The Commodore 64 version even has animation.

"It's the only serious rival to Valhala or The Hobbit", claims Tony Baden, who founded Bug-Byte with Tony Milner, "it may even prove to be a better game", he added.

You can find out for yourself if you have a Commodore 64, BBC Model B or Electron.

Twin Kingdom Valley costs £9.50.

(Trevor Hall joins Bug-Byte as Chief Programmer – see page 2).

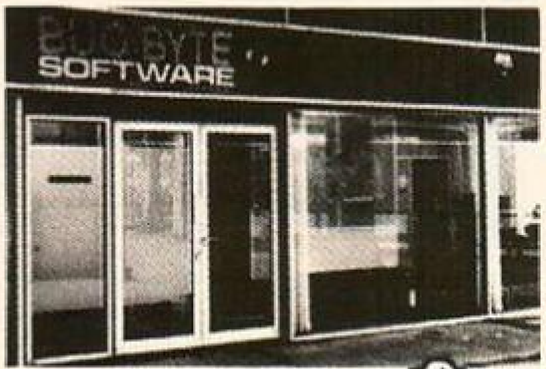
GIRL TALK . . .

Coming soon, the first major piece of Software aimed at the Female Market – watch this space!

CONTENTS

INSIDE BUG-BYTE

THE HOME OF THE BUG



It is now almost a year since Bug-Byte moved into their plush new premises in Canning Place, overlooking The Mersey.

Further structural and decorating work has recently been carried out to accommodate new programming teams in a practical working environment. This 6,000 square foot nerve centre of the software industry should see some very exciting developments during the course of 1984 – a crucial year in the development of leisure software.

THE HIT SQUAD

All good software retailers should of course already stock Bug-Byte's games. They should need no introduction to the bugs of the Liverpool based army.

For those who have yet to receive "The Call", here is a pocket guide to Bug-Byte's sales team.

The longest surviving member of staff is one Matthew Thomas. Something of an eccentric, Matthew's idea of dressing is to cover himself in glue and jump through an Oxfam Shop. This wonder kid of the tele-sales world is 22 and lives in Liverpool's horribly trendy riot torn "Liverpool 8" district. Should he ever tire of the software industry, Matthew plans to become a rock megastar, or so he says. Watch this space!

Matthew, Alison, Glyn

Alison Templeton joined Bug-Byte 3 months ago and has proved extremely helpful and popular with dealers and the public alike. Dealers without wheels might like to know her spare time is spent repairing cars!

Newcomer Glyn Jones is the "old man of the team". At 31 he's a veteran salesman and his cool, calm and collected manner and vast experience have been a great boon to the company's sales team.

Bug-Byte's Sales Manager and chief serf is 24 year old John Phillips, who has striven to get the company out of its quiet ways and back into the public eye.

It was he and Rod Cousens of Quicksilva who masterminded the Hilton dinner and awards ceremony. John has travelled extensively, flying the Bug-Byte flag both in the UK and abroad. He lists his hobbies as losing at pool, wrecking cars and as he puts it, "utilising hospitality suites".

All dealer/distributor inquiries are welcome. Just call our hit squad on 051-709 7071.

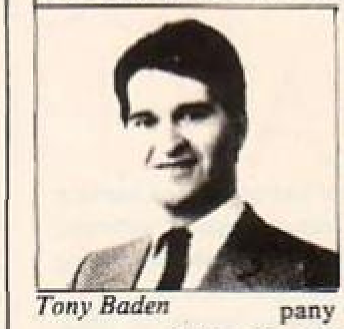
THE NAMES BEHIND THE GAMES

Tony Milner is the technical director of Bug-Byte and has a team of programmers, both freelance and in-house, at his disposal. Trevor Hall, the brains behind Twin Kingdom Valley and many other Bug-Byte best sellers, has recently been taken on full time as Chief Programmer, responsible for co-ordinating the efforts of the programmers.

A new multi-user Sage IV Computer has recently been installed to improve efficiency, together with a Pluto high-resolution graphics system. Bug-Byte are dedicated to producing the most advanced and innovative software in the market – look out for new titles.

BUG-BYTE THE STORY SO FAR

Bug-Byte Software Ltd claim to be the oldest software house in the business. They are certainly one of the most successful.



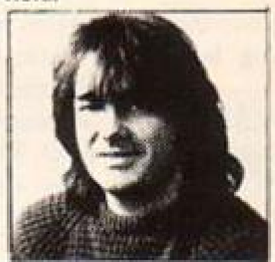
Tony Baden

"We beat Quicksilva into the market by 2 months", said co-founder Tony Baden, who with Tony Milner now heads a company worth millions, with sales literally worldwide.

All a far cry from the £3.50 classified ad. in Computing Today (then a hobbyist magazine) in July 1980. The ad. attracted 15 replies (per week) and the rest, as they say, is history.

By concentrating on top quality games and sophisticated advertising and promotion the company has led the field.

The first ever page, colour page and double page ads. were placed by Bug-Byte and the company was the first to successfully break away from mail order.



Tony Milner

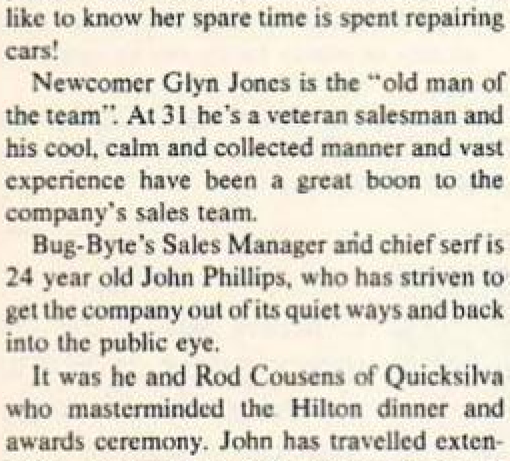
Now that its UK distribution has been moved to CBS Records in London, the company's Liverpool H.Q. is now the nerve centre for programming, marketing and sales. With outlets all over the world, all is rosy indeed for Bug-Byte Ltd., and the company is looking forward with confidence to the future and that first "Million Seller".

(You could write that million seller – see page 3).

THE SHAPE OF THINGS TO COME

Bug-Byte's new programming facilities are enabling them to work on much more sophisticated software, written by teams rather than individuals. Animated adventures and logically connected multi-level arcade games are just the starting points for Bug-Byte's new breed of 'megasoftware'.

In addition, a move into home educational software is planned later in the year. Combine this with Bug-Byte's worldwide expansion program, and 1984 looks like being a very successful year.



John Phillips and Jack Florey Commerical Director of CBS Records.

Send your programs to us . . . they could become best sellers!

THE NERVE CENTRE

and some free advice for would-be programmers

1. MAKE IT AN ORIGINAL – NOT ARCADE COPIES PLEASE.
2. MAKE IT IN MACHINE CODE.
3. LOTS OF DIFFERENT SCREENS IF ARCADE GAME – VARIETY KEEPS THE GAME INTERESTING.
4. PICTURES (& ANIMATION) IF ADVENTURE – LOTS OF SCREENS AGAIN.
5. MAKE IT FOR, IN ORDER OF PREFERENCE:- COMMODRE 64, SPECTRUM, BBC/ELECTRON, ATARI.
6. GIVE IT A PRETTY TITLE SCREEN.
7. TAKE TIME TO GET ALL THE BUGS OUT!
8. DON'T MAKE IT FOR AN OBSCURE HARDWARE SET UP – (VIC 20 WITH 3K EXPANSION & LIGHT PEN). IT CUTS DOWN THE MARKET TOO MUCH.
9. TAKE TIME TO PUT IN "PROFESSIONAL" TOUCHES WHICH AREN'T REALLY NECESSARY TO PLAY THE GAME – PRETTY BACKGROUNDS TO THE SCREEN, WELL DESIGNED CHARACTERS, REALLY SMOOTH & FLICKER-FREE ANIMATION, GOOD SOUND EFFECTS ETC.
10. SEND IT IN. YOU HAVE NOTHING TO LOSE – THE REVIEWING SERVICE IS TOTALLY FREE. AT WORST, YOUR CASSETTE WILL BE RETURNED TO YOU WITH RATING OF ITS WORTH AND SUGGESTIONS FOR IMPROVEMENT. IF BUG-BYTE LIKES THE PROGRAM, YOU ARE UNDER NO OBLIGATION, UNTIL AGREEMENT HAS BEEN REACHED OVER PAYMENT FOR IT.

FREE INFORMATION PACK

Are you interested in becoming a Bug-Byte freelance programmer – if so, fill in the coupon at the bottom of this page and send it to Bug-Byte. You will receive by return an information pack containing further details of what we require and how payments are made.

IF YOU ALREADY HAVE A MARKETABLE PROGRAM, send a cassette or disk copy into us using the same coupon below. There is no obligation. We will return your cassette, together with suggestions for improvements, or an offer, normally within 10 days.

Send coupon to:
Trevor Hall, Chief Programmer,
Bug-Byte Ltd., Mulberry House,
Canning Place, Liverpool.

CHANGES FOR 1984

To date, most of the software marketed by Bug-Byte has been developed by freelance programmers working from home and being paid royalties on copies sold. Although this has proved generally satisfactory, Bug-Byte feel that with the current and future advances in state-of-the-art software, and the demand for increasing sophistication, there is a need to develop a significant in-house capability composed of teams of programmers rather than individuals. This will result in more efficient and sophisticated software in the future.

Bug-Byte are currently in the process of adapting part of their office complex to accommodate such programming teams, the first of which will be fully operational by the end of February.

HOW THE SYSTEM WORKS

Starting with a vague idea for a game, the first step is to expand this to a fairly comprehensive layout on paper, of how the various screens will look, what characters will be required, how they will move around, etc. Assuming that at this stage the idea still looks like it will make a good game, the programming team leader will set about the task of converting ideas to block diagrams and algorithms – fairly specific routines being given to the coders in the team to convert from algorithms to machine code.

In this way the main program will be gradually built up – versions for several home computers being developed concurrently. The actual programming will be done on a large development system involving shared hard-disk storage on which a library of routines and utilities will be built up. Testing of the programs for debugging involves downloading them to the computer being written for.

Designing the graphics for the game (backgrounds, characters and title screens) is a separate process from the coding.

This will be carried out by the artistic element of the team using specially developed utilities allowing him to not only design pictures, but store them on the disk, in the format required by the coders for later use.

During the later stages of development, artwork, documentation and advertising will be organised so that the product can reach the market with minimum delay.

FREELANCE PROGRAMMERS STILL NEEDED

Despite setting up in-house programming teams, Bug-Byte are still interested in dealing with freelance programmers, either individuals, groups or smaller software houses. Either a royalty contract or an outright purchase of copyright will be offered. The programming department offers as much support as possible to good freelance programmers, including the loan of any additional equipment necessary for speedy completion of a program.

WHAT IS IT WORTH?

Royalties are paid at a fixed rate per cassette rather than as a percentage of sales. Beware – smaller companies may offer what appear to be high royalties on nett sales, but they may offer very high discounts for dealers, and in any case they will not sell in anything like the quantity that Bug-Byte games sell in. For a fairly good selling program, the author can expect to make between £5000 and £10,000 in the first year, and for a game that is a top 20 hit, between £10,000 and £40,000 in the first year in royalties. These are not wild claims – the figures are based on recent experience and can be supported.

☐ I enclose a program entitled ....
for the ....
computer, which is my own original work. I would be interested in having it marketed by Bug-Byte Ltd., subject to a satisfactory financial arrangement. I would prefer

☐ Lump sum for purchase of copyright.

☐ Royalties on sales

I understand that I am under no obligation.

Signed ....

☐ Please send me a free Programmers Information Pack

Name ....

Address ....

....

Telephone .... Age ....

Bug-Byte's liability is limited to replacement of the medium on which the program is recorded.

DEALERS CORNER

plus our special promotions

CALLING ALL COMPUTER DEALERS

Are you taking advantage of our 48 hour despatch service by ordering direct from CBS Distribution? If you have a CBS account, all you have to do is telephone CBS Distribution on 01-960 2155 with your order. Please quote our catalogue numbers when ordering – these are given in our new 1984 catalogue, which you should have received – if not, please phone our tele-sales staff on 051-709 7071. Orders may also be phoned through on this number – we will pass them on quickly to CBS – this may be better for you if you require information on our products when ordering.

If you do not have a CBS account, one can easily be opened – just phone for details. Bug-Byte Software is also available from the following distributors: Websters, Tiger, Microdealer UK, PCS, Microdeal, Express Marketing, Calisto, Lightning.

IMPORTANT Please note that most distributors do not stock the whole Bug-Byte range. If you do use a distributor and he doesn't stock a particular line you require, please ask him to start stocking it, or you can obtain it from CBS Distribution, who stock the complete range.

Current Bug-Byte standard trade discount: 35% off VAT inclusive RRP. Larger discounts available for over 1,000 units (mixed).

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Order your high-quality cotton T-Shirts by post.
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Liverpool L1 8JB

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BUG-BYTE GIVE AWAY HUNDREDS OF £££'s

Watch out for Bruce the Bug's Lucky Tapes!

Just 100 Special editions of our forthcoming new releases, 'Antics' and 'Mattie goes Mining' will include an extra program.

If you are a lucky winner, you will receive a crisp £10 note when you send the program back to us. You will also have your original tape replaced with a brand new one, and also receive a 'bonus' tape of another title.

So go out and hound your local dealer to stock 'Antics' and 'Mattie goes Mining' – and you could win a super prize!

SEND FOR YOUR BUMPER BUG-BYTE POSTER PACKS!

For just £1 inc. p & p, we will send you 4 posters in glorious full colour of some of our best selling programs.

You will also receive a full colour Bug-Byte car sticker, and our new 1984 Catalogue, packed with details of your favourite programs.

MAIL ORDER COUPON

If you have difficulty obtaining any Bug-Byte product from your local dealer, you can order from us by direct mail. Just send cheque/P.O. for the advertised price of the program in our latest catalogue.

Postage is free of charge.

Mail to: Paul Scattergood, Bug-Byte Ltd., Mulberry House, Canning Place, Liverpool L1 8JB.

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Size ....
Quantity ....
Total Price ....

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Address ....
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Allow 21 days for delivery

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SCOPE is a fully structured multitask language specifically for writing graphics, animation and sound. Being fully compatible with BASIC it is ideal for writing both arcade and adventure style games. Additionally, with SCOPE present in high memory it can be used as an assembler with SCOPE words as plain language mnemonics. Therefore no knowledge of machine code is required. The language is extremely easy to comprehend and is very powerful indeed providing many features not available from BASIC.
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F

GET THE RIGHT ANGLE ON YOUR SPECTRUM

Trickstick turns your Spectrum into the most sophisticated games machine in the world. Your fingers rest on the Trickstick's six sensitive pads (four directions and two fire buttons) and the harder you press the faster you go or the harder you turn.

Trickstick works by picking up mains hum from your body and converting it by an ingenious circuit design directly into digital input. Proportionality gives vast possibilities for more interesting games.

- Each Trickstick comes with its own interface included in the price.
- Up to eight interfaces can be stacked into each other for 1-8 simultaneous players. (Own 1-8 player game is Attaktics at £10).
- Works with most Kempston compatible software, and with our new programmable adaptor (£10 for Trickstick owners) it works with ANY software.
- Easy to program, even for proportional games.
- In the shops soon. Now available by mail / telephone order at £34.50.

TRICKSTICK-
The revolution that Runs Rings round ordinary joysticks

THE 80k SPECTRUM – £57.50

Upgrade your 16k Spectrum to a full 80k with the SP80 – a 64k expansion kit giving two 32k pages above address 32767. Not recommended for beginners, but ideal for the serious programmer. Pages are switched using software instructions only, and an LED indicates which page you are on. The other page is isolated from the system, but retains all its information until switched back.

The SP80 simply plugs into the sockets in the 16k Spectrum. Full fitting instructions are provided. It is easy to fit and no soldering is required.

See 48/80 FORTH for another angle.

48/80 FORTH

48/80 FORTH – £14.95

The latest, best and most complete version of this popular language for the Spectrum. FORTH runs many times faster than machine code; – a tonic if you're fed up with all those GOTOs.

Each tape includes both a 48k version and an 80k version (for use on Spectrums upgraded with our SP80. SP48 owners are offered a part-exchange price of £18 if they upgrade to 80k).

The manual provides both the normal technical definitions of the language, and an outstanding brief introduction for the beginner. Each tape also includes a superb EDITOR program to give you full control of the 16 (48k) or 32 (80k) disk screens.

A FORTH Toolkit (giving floating point etc) and an extension for the Microdrive will be available shortly. 48/80 FORTH uses standard FIG-FORTH definitions with extensions to exploit the special characteristics of the Spectrum, including BEEP (for real arcade quality sound), DRAW, PLOT and CIRCLE.

BEYOND HORIZONS – £4.50

This teaching program has already made computing less mysterious for thousands of people. It guides you through the Spectrum 48k memory, teaches you to PEEK and POKE systems variables, shows you how the display file and colour attributes work, how a BASIC program is stored byte by byte, and much much more. Outstanding value for those who get stuck on the second half of the Spectrum manual.

SP48

UPGRADE YOUR ISSUE 2 OR 3 SPECTRUM FOR JUST £23 AND GET A £4.50 COPY OF BEYOND HORIZONS ABSOLUTELY FREE

The SP48 simply plugs into the sockets provided by Sinclair in your Spectrum. Easy to fit, full instructions provided and no soldering. Fits both Issue 2 and Issue 3 machines and gives you a standard 48k Spectrum. And no other expansion kit allows you to upgrade later to the 80k Spectrum. Over 20,000 16k Spectrum owners have already upgraded with the SP48. Join them.

And you get a free copy of BEYOND HORIZONS, so there's yet another angle to look at.

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____	Attaktics £10.00	
____	SP48 (Issues 2 & 3 £23	
____	SP80 £57.50 (Please specify which issue)	
____	48/80 FORTH £14.95	
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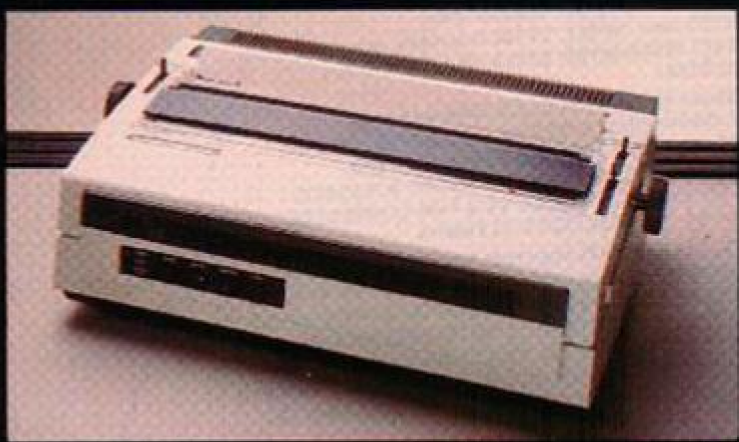

Printer	Price
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Silver Reed EX500 Serial	378.35
Silver Reed EX550 Parallel	534.75
Silver Reed EX550 Serial	569.25
Epson RX80	320.85
Epson FX80	503.70
Epson RX80 (F/T)	366.85
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Epson FX100	654.35

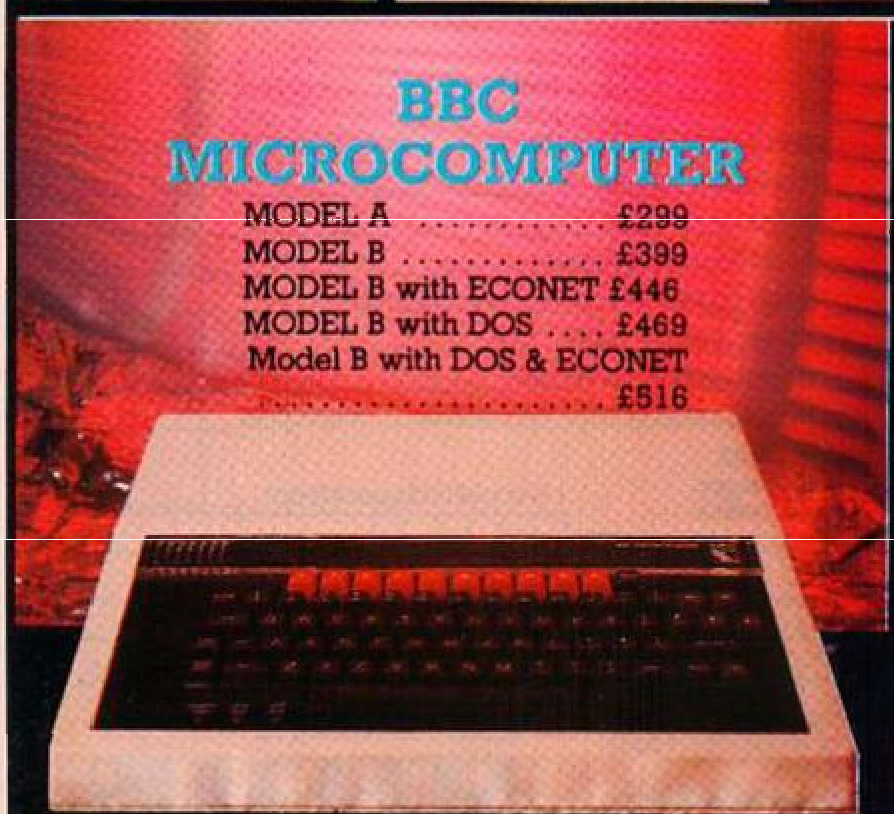
COLOUR LIGHTPEN

The lightpen is compact, reliable and comes in a rugged metal case providing physical and electronic protection. Its sensitivity can be adjusted to match any make of TV screen, giving the highest levels of accuracy.

The lightpen package consists of the lightpen, an interface unit, introductory software on cassette and a user guide.

£45.95

MONITORS



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MODEL B with DOS £469
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DECCACOLOUR 14" Colour Monitor £247.25

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The Bell & Howell/LVL Computer Compatible Data Recorder

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- O Tape Counter
- O Remote Motor Control

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Durell Software

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ENGLAND

Harrier Attack — ORIC-1 and SPECTRUM

Pure machine-code, super-fast, action-packed, highly addictive arcade-style game requiring great skill. The harrier takes-off from an aircraft-carrier and flies over seaborne defences to attack enemy installations on a nearby island. The harrier may fly faster, slower, higher or lower, and has bombs and rocket fire with which to protect itself and make its own attack. If it flies too high it is detected by enemy jet-fighters (which it may counter-attack) – so it needs to hug the mountainous terrain which also varies with every new game. But the island is heavily defended by anti-aircraft rockets and tanks, which again the harrier may counter-attack or try to fly through. A tally is kept of fuel, bombs and rockets, plus player score and high score. Finally the harrier must make its bomb-run over the enemy base before returning to its own carrier.

ORIC APPROVED VERSION £6.95
SPECTRUM VERSION £5.50

Starfighter — ORIC-1 (48K only)

You are in command of a galactic defence vessel travelling through inter-stellar space to attack and destroy intruding aliens. At long range this is carried-out on your computer scanner which displays stars in the local quadrant, with passing planets, space stations, star-gates, and of course the aliens which may strike in packs or singly, scattering anti-matter mines around your ship. You may counter-attack the aliens with your photon torpedoes, or if you move-in close enough switch over to manual and visual control to chase the fleeing alien and blast him with your phasors. See the star-scape spin relative to your ship's manoeuvres, but watch-out for the alien mines whizzing past. You will need to conserve energy carefully to get back to the refuelling points, and then the time-gates to the other quadrants. Weapons, shield and energy status are all monitored throughout this pure machine code game, which may be set to ten levels of skill.

ORIC APPROVED VERSION £6.95

Galaxy 5 — ORIC-1

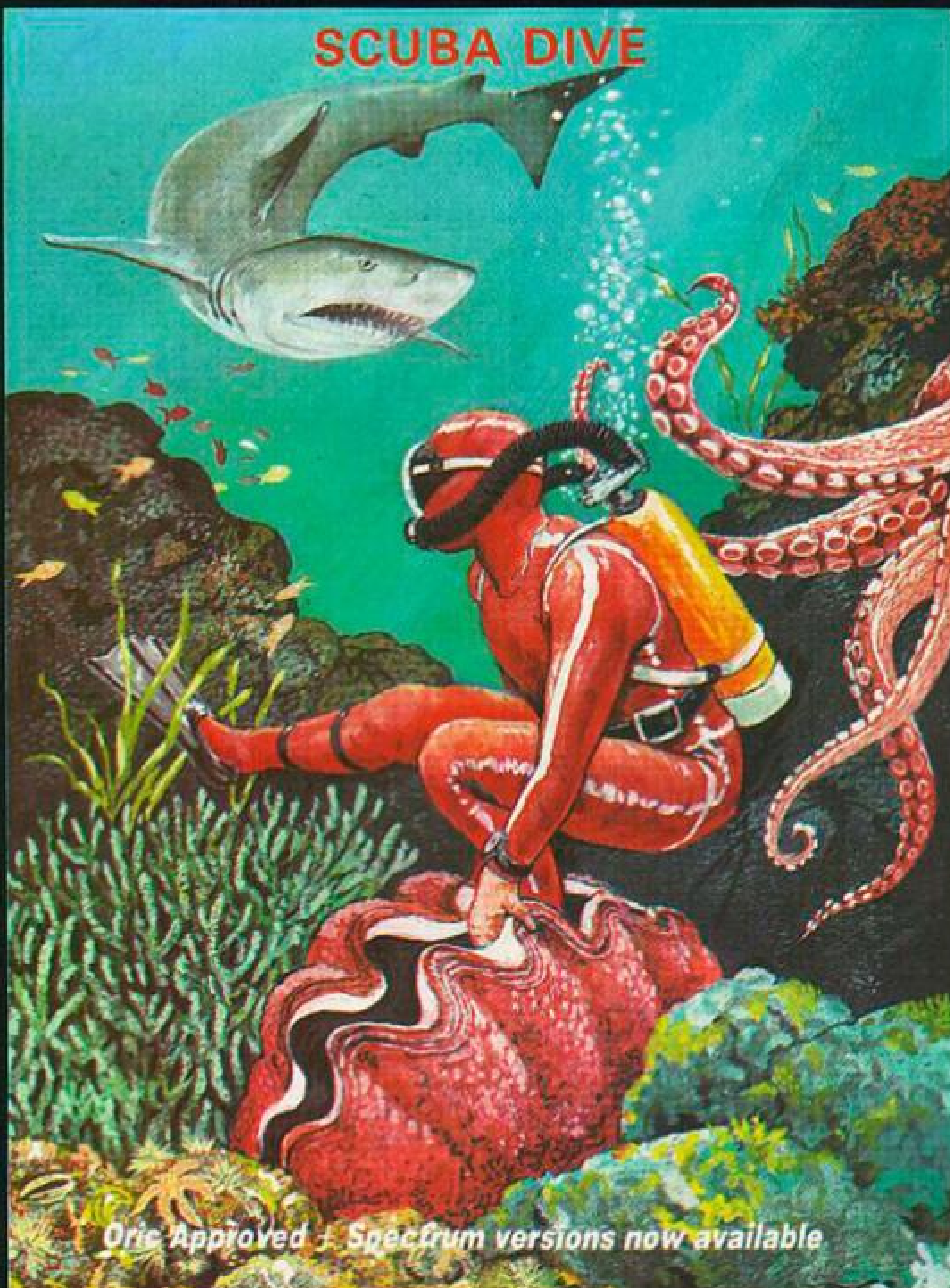
Side one of Galaxy 5 contains three pure machine code arcade type space games. They consist of 'Galaxy' which is a Galaxian-type game with 15 winged aliens swooping down to bomb a left/right controlled rocket launcher in groups of one, two or three. Next 'Astro War' is an asteroids-type game with a meteor shower moving sideways across the screen towards your ship which has right,left,up and down controls plus phasor fire to blast the meteors along with any aliens that may be hiding amongst them. The last game on this side is 'Space Chase' which gives a view from your cockpit of a fleeing alien. You fire at him and he fires back, so you must get a direct hit quickly before he destroys your force shields. Side two of this tape consists of two more arcade type space games but this time in BASIC, which are easy to learn from, being short, simple and clearly written with every line of the BASIC explained in an English REMark statement.

ORIC APPROVED VERSION £6.95

Jungle Troubles — SPECTRUM

Pure machine code with super cartoon graphics. This original and witty game is set in the depths of the African jungle. First you must direct your man to collect an axe and cross a nearby river via stepping stones that protect him from a lurking crocodile. Then he must climb a ladder to the next level, where he has to fell a number of trees in his path. As he does this a marauding ape appears from the left of the screen and steals his axe! So back to the start for another axe and more problems with the crocodile! And the ape! Having hacked a path through the forest he may climb another ladder to level three where he has to leap a pit of flames by grabbing a swinging rope. Will he ever escape back to the city? Can he jump the chasm that suddenly opens before him just as he is about to reach home? A highly amusing game with delightful graphics suited to all members of the family – but very frustrating and addictive.

SPECTRUM VERSION £5.50



Scuba Dive — ORIC-1 and SPECTRUM 48K

Pure machine code with super cartoon graphics. You are in control of a diver who must swim down through jellyfish, sharks, barracuda and a host of other undersea nasties to locate the entrance of a submarine cave. He must then follow its twisting and branching passages which change with every new game, to locate the giant oysters with their fabulous treasures of enormous pearls. However, many of the passages lead to dead-ends, while some are filled with horrible underwater monsters, and even the giant oysters are liable to snap-shut and catch the diver just as he reaches out his hand. Each dive has to be timed carefully so that there is enough oxygen left for the return journey, which is further frustrated by the diver's boat shifting anchor and threatening to cut his head off with its propellor.

ORIC APPROVED VERSION £6.95
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Really original. All Pat has to do is collect parcels whilst avoiding obstacles – like cars, fires, trains, etc. Skill level and Hall of Fame.
48K Spectrum. £6.95

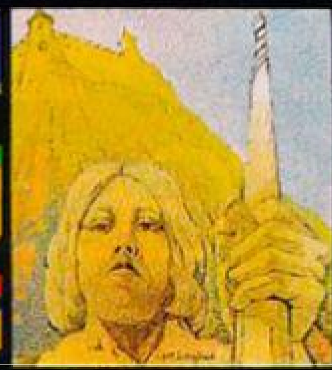
Deffendar
Earth is under attack from mutant aliens in an accurate implementation of a top arcade game – and one of the most difficult to survive in!
48K Spectrum. £6.95

Cruise Attack
Save the city from annihilation in this wonderful version of an arcade favourite. Nine skill levels, bonus points for attack ships.
48K Spectrum. £6.95

Nanas
Catch the bananas, miss the coconuts. Easy? Try it and see. Simple in concept, hilariously entertaining – it'll drive you bananas.
16K Spectrum. £5.95

Timequest
A warp-space accident spreads your capsule across time. As you land in each new era, fresh perils face you. A very skillful graphic adventure
48K Spectrum. £6.95

One Hundred & Eighty
That famous shout tells you what it's all about! A good implementation of a difficult game – doubles, trebles, twenty-five and bull all possible.
48K Spectrum. £6.95

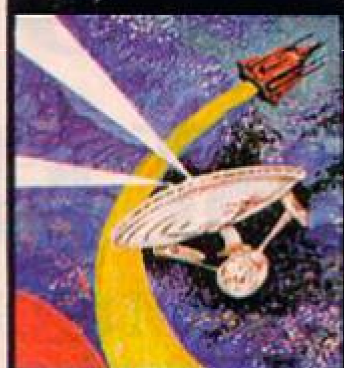


Land of Sagan
A quest to find the long lost Staff of Health. Is it in one of the castles? Or in the Tower? There are plenty of problems – and plenty of opponents – in this great graphic adventure.
48K Spectrum. £6.95

Creepy Crawler
An authentic version of one of the most addictive arcade games devised. All the usual features (Centipede, Spider, Bug, etc) with full use of Spectrum graphics and sound.
16K Spectrum. £5.95

Mad Martha II
Great sequel to the best-selling Mad Martha. Hilarious graphic adventure, with hero Henry in sunny Spain, beset by wacky waiters, mad bulls and the wrathful Martha.
48K Spectrum. £6.95

SAS Assault
Your mission – rescue the Russian ambassador from terrorist kidnappers, before the Kremlin declares war. Loads in two parts – your rating in the second depends on your skill in the first.
48K Spectrum. £6.95



Star Trek
Defend the star systems against the Klingon attack. Runs in real time – so you have to make the right decisions fast!
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Drakmaze
Find your way round Dracula's domain. A game to get your teeth into!
48K Spectrum. £6.95

Laserwarp
Invaders, Aliens, this game has the lot – and you have to survive to destroy the Master! Simple controls, far from simple task.
48K Spectrum. £6.95

Knockout
No aliens, lasers, invaders or rockets – just simple but absorbing fun which up to 4 players can enjoy.
48K Spectrum. £6.95

Galakzions
Watch out as the Galakzions break formation to attack in such force that no mere human can survive!
16K Spectrum £5.95

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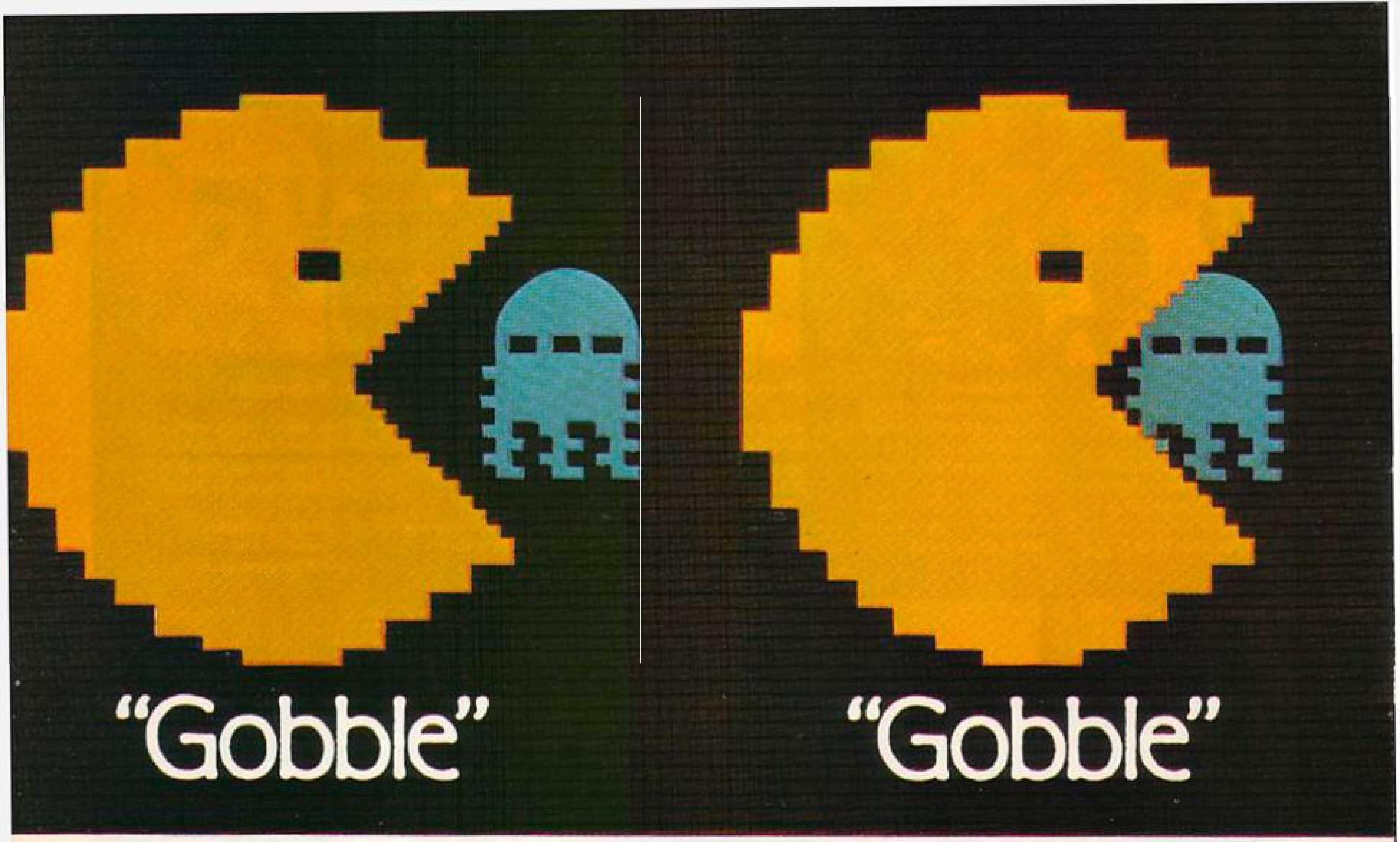

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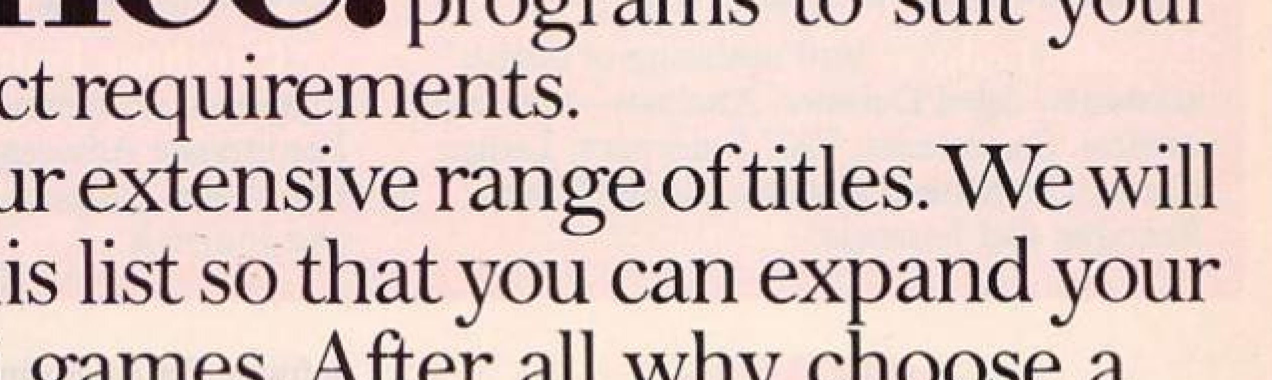

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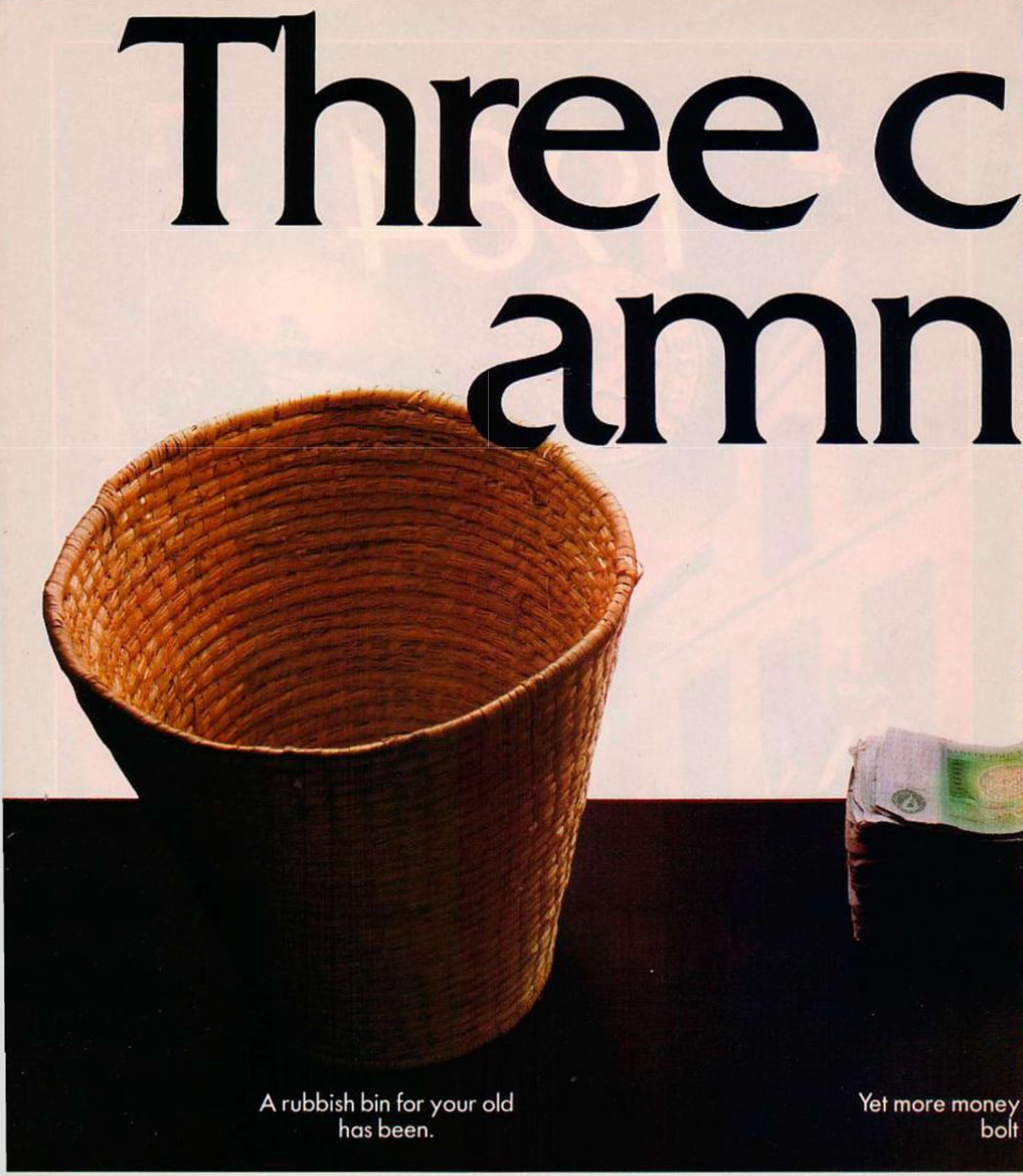


Believe it or not, computers often suffer from amnesia.

99% start off with large enough memories, but operating functions like text, colour, sound and more particularly high resolution graphics, take large bytes out of them. Leaving very little "useable" memory for programming and games.

Not so the new Oric Atmos 48K.

This is the one home computer that takes these normal working functions in its stride.

Unlike other home computers it uses the highly sophisticated serial attribute handling method used by Viewdata and Teletext, in which the attributes are stored on the screen alongside the data, instead of taking up space in the memory.

Thus the Oric Atmos never offers less than a healthy 37K of useable memory – even when the new colour printer and disc drive unit are attached. (Technical buffs see details overleaf).

So it rivals the performance of the supposedly larger, more expensive Commodore 64K, which unfortunately loses 26K of its "elephantine" memory in high resolution graphics.

It beats its immediate competitors like the Sinclair Spectrum, Dragon 32K, Vic 20 and Atari 600.

ures for esia.

It beats the Lynx 48K, which costs over a third more, yet loses 34K.

It even beats the Acorn Electron and the BBC Micro which costs more than twice as much, yet loses 23K in high resolution graphics.

And while this may surprise you, it's totally in keeping with a company recognised in the computer industry for performance and innovation.

Like its predecessor, the Oric-1, the Oric Atmos has the powerful loudspeaker and amplifier unit that prompted "Which Micro" (November issue) to comment…"Its sound facilities have more in common with those of the £400 Beeb, than the rather pathetic beep of the Spectrum. At full volume it can compete with most arcade games…"

Yet the Oric Atmos 48K costs a mere £170, including all the leads and adaptors you need to get it going.

So if you're buying a computer, remember our name. We could save you a fortune on bolt-ons…or wastepaper bins.

The new Oric Atmos 48K. ORIC

Now we've whetted your appetite, here's something to get your teeth into.

Printer Technical Specifications

Printer/Plotting system	Ball Point Pen, 4 colour
Plotting speed: (horizontal)	52 mm/sec (2.05ips)
(vertical)	73 mm/sec (3.08ips)
Printer Speed	12 characters per second
Resolution	0.2 mm/step (0.00787 inch)
Effective plotting range	96 mm (3.804 inch) x axis, divided into 480 steps. (No limit in y direction)
Characters per line	80 or 40 text mode (determined by software in graphics mode)
Characters per line	INT (480/n+1) *6) for 0=n=15
Accuracy (repetition)	0.2 mm max
(movement)	0.3 mm max
(distance)	0.5% max (x – axis) 1% (y – axis)
Pen life	250 metres (825 feet)
Parallel interface	8 – bit parallel Uses STROBE and ACKNOWLEDGE
Temperature range	18.3 to 35°C (65 to 96°F)
storage	– 40 to 71°C (.40 to 160°F)
Humidity range	10% to 80% relative non-condensing
Power supply	Switching power supply input 100 – 120 VAC 200 – 240 VAC
Dimensions	10¾" wide 6⅞" deep 2½" high

Atmos Technical Specifications

CPU	6502 A
Memory	Choice of 16K or 48K RAM
Memory (48K Model)	Minimum 48K RAM, max 64: 16K ROM external control signals allow use of full 64K RAM or maybe used externally to increase ROM/RAM
Language	Extended Microsoft basic
Keyboard	Typewriter style and pitch, 57 keys, standard computer layout, additional cursor control keys, autorepeat facility, tactile and acoustic feedback
Display	Output for B&W or colour TV, RGB output for colour monitor.
Text format	40 line x 28 rows
Character set	Similar to Teletext format, standard ASCII double height, flashing, 80 user definable characters
Graphics	240 x 200, 8 colours
Graphic Facilities	Points, lines, circles
Sound	Internal loudspeaker and amplifier. 3-Channel sound synthesiser envelope control, amplitude control 8 octaves, noise channel
Storage	Most cassette recorders via DIN socket 300 or 2400 BAUD. Disc Drive.
Interface	Centronics, expansion port, Hi-fi, RGB Monitor, UHF TV, cassette recorder
Other	Warm reset to regain control without clearing program or data

Micro Disc Technical Specifications

Formatted Capacity	160K bytes per side (double density as standard)
No. of Tracks	40 (80 available as option at a future date)
No. of Sectors	16
Bytes per Sector	256
Transfer Rate	250K Bits/Sec

Supports up to 599 files per side, four drives single or double sided, 40 or 80 track. User definable configuration allows mixing of drive types including 5 ¼" (five and a quarter inch)
Extensive wild card facilities
Copy allows merging of basic and machine code files

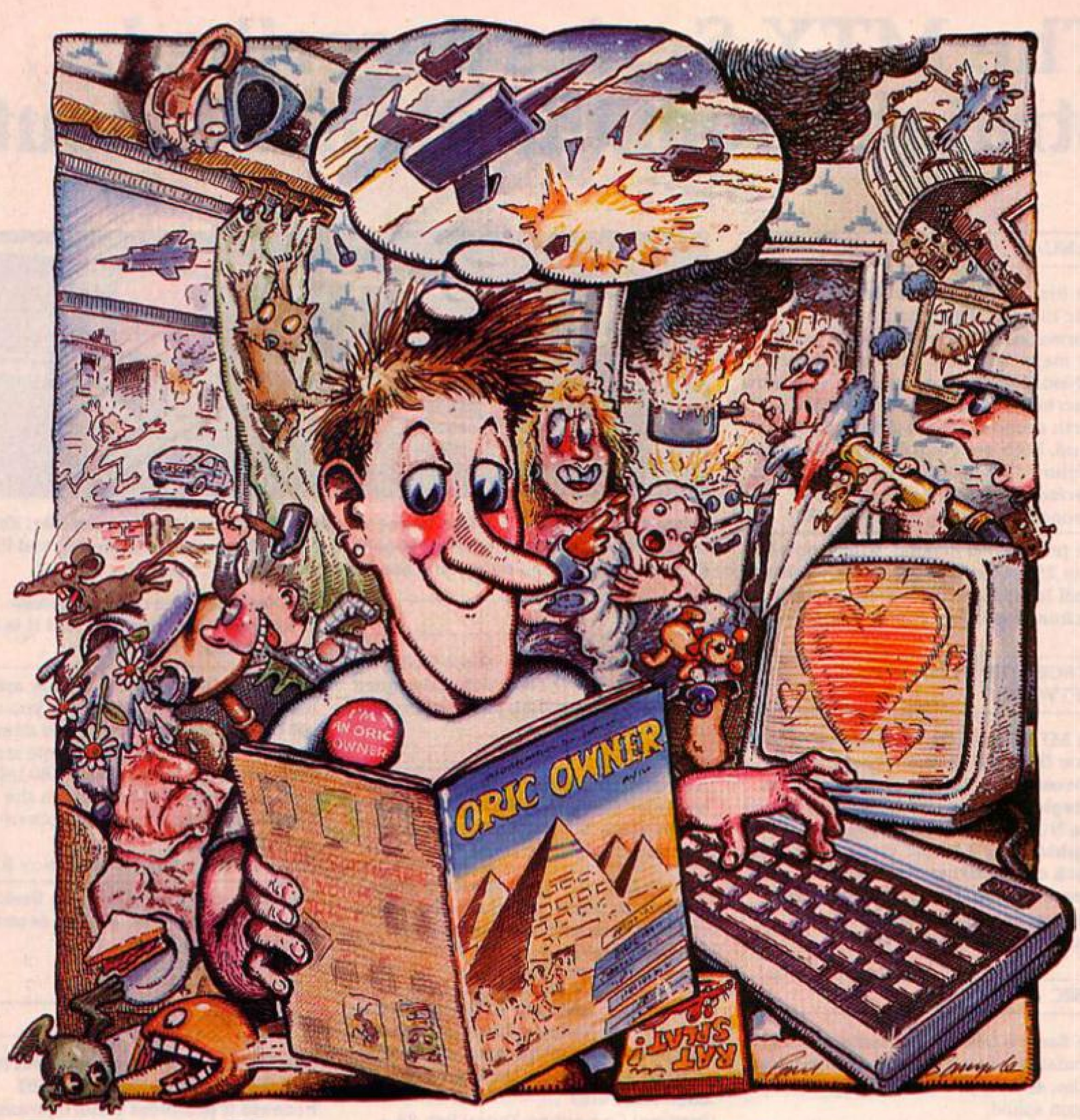
Utilities

The Utilities are as follows:

1. Backup	Copy a whole disc
2. Copy	Copy a file to another
3. Del	Delete a file allowing wildcards
4. Dir	Display directory listing
5. Drv	Set the default drive number
6. Format	Format and initialise a disc
7. Load	Load a file (code data or basic)
8. Protect	Change protect status of file
9. Recall	Recall a basic array from a file
10. Ren	Rename a file
11. Save	Save a file (code, data or basic)
12. Store	Store a basic array as a data file
13. Sys	Change system configuration

Prices and data correct at time of going to press.
Specifications on the above models may change without notice.

Available at Dixons, Laskys, Comet, Wigfalls, Rumbelows and all good computer stockists.


I'M AN ORIC OWNER
ORIC OWNER

The MTX Series described; straight from the author's mouth

MANUAL

The first section (of the manual) is a basic tutorial. The grass roots information is here and I could not find any major mistakes. The second part is on Noddy giving a good guide as to how it can be written. . . . The third and fourth sections are on graphics and sound. Both are quite detailed and easy to follow. The fifth section is on how to interface Assembler to Basic.
Personal Computing Today Feb 84.

The provisional manual, which runs to some 250 A4 size pages, has a wealth of detail for the machine-code specialist.
Electronics and Computing Monthly.

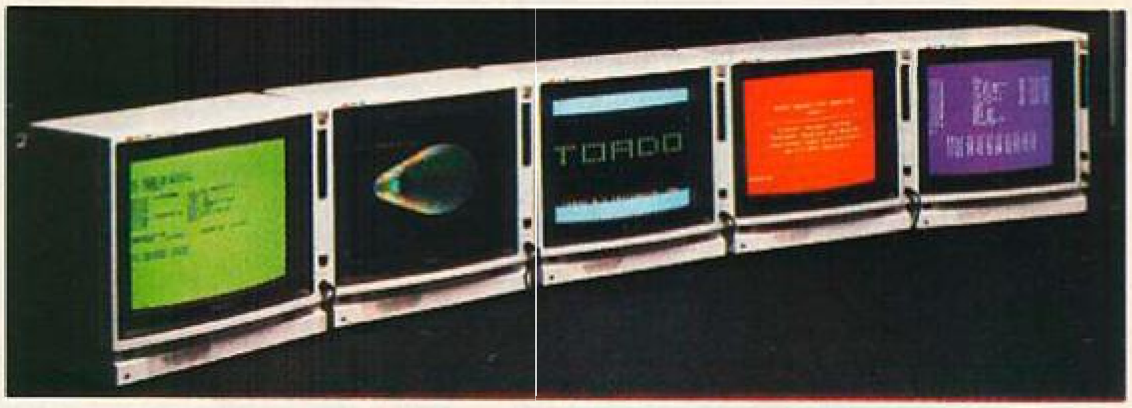
INTEGRATED INTERACTIVE SOFTWARE

The MTX ROM has been designed to allow the maximum interaction between components of the software. A single program can be written which uses NODDY to display text and graphics, and a BASIC control program which calls routines written in assembly code. This is a feature of future generation computers not available on any other micro.

BASIC

The Basic is fast and accurate, all the calculations being done in floating point maths, so that you don't lose accuracy to gain speed.
Personal Computing Today Feb 84.

The latest addition to the Memotech range DMX80 Matrix Printer – 80 characters per second print speed, eight character formats, dot addressable graphics, **£295.00 including VAT.**



Integrated Software – a five to one advantage. Assembler/Disassembler, High resolution Graphics, Arcade style games, Noddy for easy text handling and Front Panel for testing and debugging machine code.

NODDY

A language new to me called Noddy is included in the MTX which is designed to make text handling easy, especially for beginners.
Hobby Electronics.

Also provided is the easy to use beginner's language (Noddy) and a child oriented learning language Logo.
Practical Computing Dec 83.

(Noddy has only 11 commands) that need to be mastered before some quite complex question-and-answer-type programs can be written.
Your Computer Nov 83.

Noddy's . . . main use is for displaying text and I can see applications in the computer assisted learning (CAL) field. Writing in Noddy is like a mixture of Logo and Forth.
Personal Computing Today Feb 84.

ASSEMBLER/DISASSEMBLER

The Assembler can be accessed through BASIC. When used in conjunction with the PANEL it enables the programmer to single step through and test machine code programs. This is not new to computing, but it is to a home micro.

As well as being able to modify and disassemble sections of code, you can set break points, examine and alter register values, and even single step through code. I hope other Z80 micro manufacturers (particularly in the Cambridge direction) take note of these debugging aids.
Popular Computing Weekly Nov 83.

The Assembler is called from Basic, and it assembles the code in situ, as part of the Basic listing.
Hobby Electronics.

Z80 BOARD

The MTX Series is a more powerful tool for education than the 6502 because it produces a more powerful assembler, allows the PANEL function to be used, and enables integrated software to be written.

RML's 450Z has a (PANEL) function but that is a computer which costs considerably more than the MTX 500.
Hobby Electronics.

FULLY INTEGRATED AND EXTENDED GRAPHICS

The only aspect of the series where extensions to standard language are allowed is in the most comprehensive and integrated graphics available on a home micro.

32 Sprites are supported either 8 × 8 or 16 × 16. They are easy to use and define and do not use extra memory as in the BBC B because they have their own area of RAM.
Personal Computing Today Feb 84.

Graphics are very easy to create and manipulate, even for beginners.
Which Micro Jan 84.

MTX512 plus twin 5 1/4" disc **FDX**. A CP/M based business system – **£1245 inc VAT.**

SOUND

The simplification of the sound commands for ease of programming has in no way compromised the quality of the sound produced.

Sound is of great importance for use in games but on many microcomputers it is inadequate. Not so with the MTX . . .
Your Computer Nov 83.

As well as good graphics capability the MTX boasts the same sound chip as the BBC micro – the Texas 76489. It has three tone channels and one noise channel, and is easily controlled from Basic. Volume and frequency can also be controlled, using a much easier method than the 14 parameters needed by the BBC.
Popular Computing Weekly Nov 83.

The commands are sufficiently complex to enable the computer to be used as a synthesizer.
Electronics and Computing Monthly.

CP/M OPERATING SYSTEM

The Series is designed to run under the CP/M operating system. This is the Disc Filing System used on the vast majority of microcomputers in business. Since a program written on one CP/M machine can be transferred and run on almost any other, this makes available 15,000 CP/M based business programs. The powerful LINK program can give access to any device operating under CP/M. With its excellent software support and because of it's modular nature, the series is a cost-effective and efficient entry to serious business and educational computing.

FULL-TRAVEL KEYBOARD

It has a professional quality keyboard. This and its elegant styling make it suitable for word processing and business use.
Your Computer Nov 83.

Input/Output Monitor, Hi-Fi, Power, TV, Centronics, Cassette Mic and Ear, and two Joystick ports all come as standard; the twin RS232 ports are available as expansions.

HARDWARE

Inside the case is what one comes to expect from Memotech – a very neat PCB that holds all the components including the main chips – namely a Z80A processor and TMS 9929 graphics chips as well as about 30 others.
Popular Computing Weekly Nov 83.

If you are familiar with the ZX81 peripherals that Memotech also make you will know that the company has an eye for good design and does not skimp on materials it uses.
Electronics and Computing Monthly.

NODE RING

MTX computers can operate together without expensive network systems. Units linked via the ring can share software peripherals and communicate with each other. Many other makes of computer can be interfaced with the ring as terminals.

EDUCATIONAL USAGE

There will be many people who have seen a front panel display on the 380Z computer in secondary schools or colleges, and the MTX panel is very similar.
Hobby Electronics.

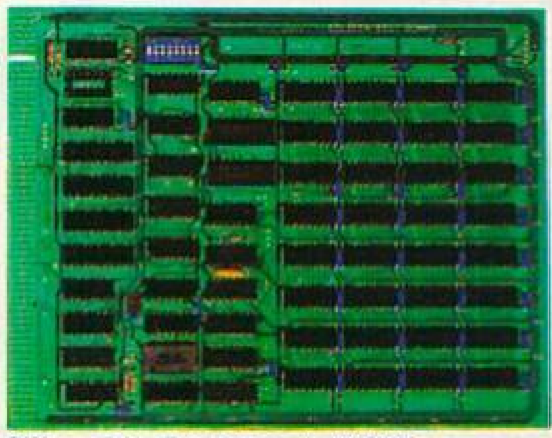
The new language Noddy and the Logo type Turtle Graphic commands would appeal particularly to the growing education market.
Your Computer Nov 83.

Applications are obviously going to suggest themselves in areas of the school curriculum, the fast-training of personnel in commerce, and in adventure-game writing.
Hobby Electronics.

The MTX expansion potential is well thought out. The key to both the MTX Ring system and to the Disc Drive systems is the communications (RS232) board mentioned earlier.
Electronics and Computing Monthly.

UPGRADABILITY

The MTX 500/512 is part of an existing range of products which can be bought separately and integrated into a single powerful system, now.



Silicon Disc RAM Board 256K fast access RAM

There is plenty of room for expansion with the MTX and Memotech have planned a progression up to their small business machine with 80 column display (instead of the standard 40 × 24) Floppy discs, Silicon (or RAM) discs, and a hard disc under development.
Personal Computing Today Feb 84.

There are a multitude of sockets along the back consisting of two Joystick sockets, cassette connections, Centronics printer circuit, aerial socket, power socket and audio and video output. There is also provision for two RS232 sockets . . . in addition the left hand end of the case has a large expansion socket with all the CPU signals on it – Memotech thoughtfully supply a plastic Blanking Plate to protect and conceal it when not in use.
Popular Computing Weekly Nov 83.

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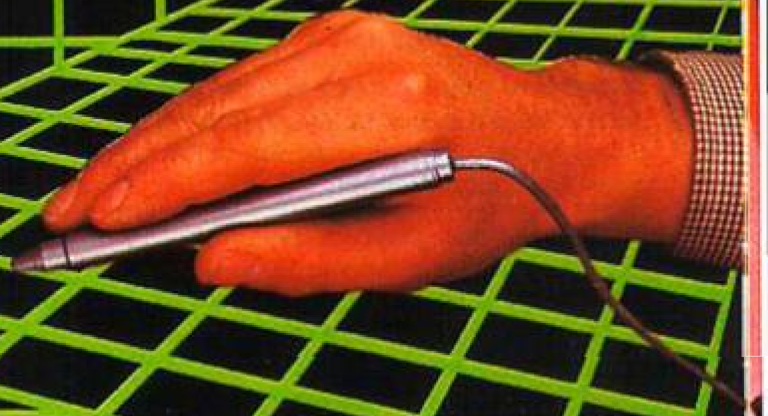

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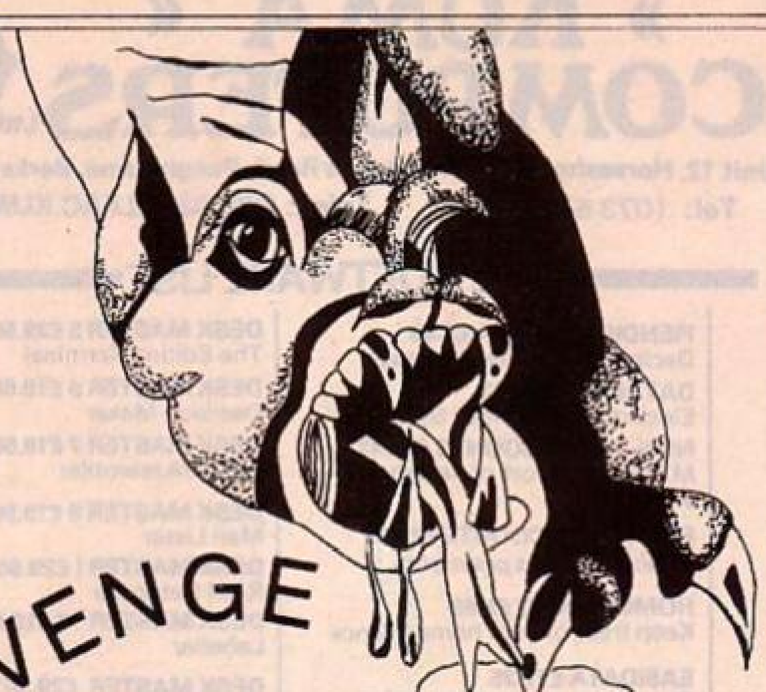

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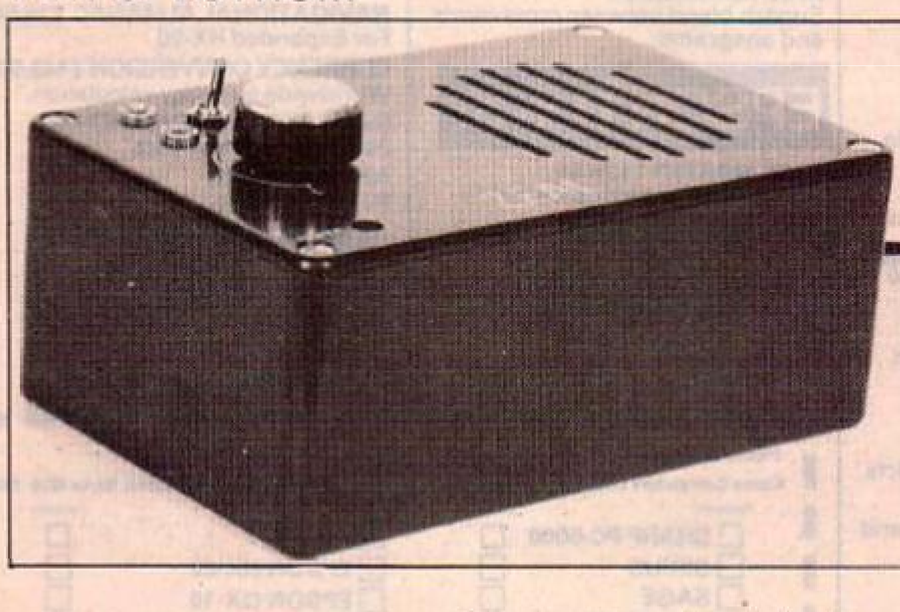

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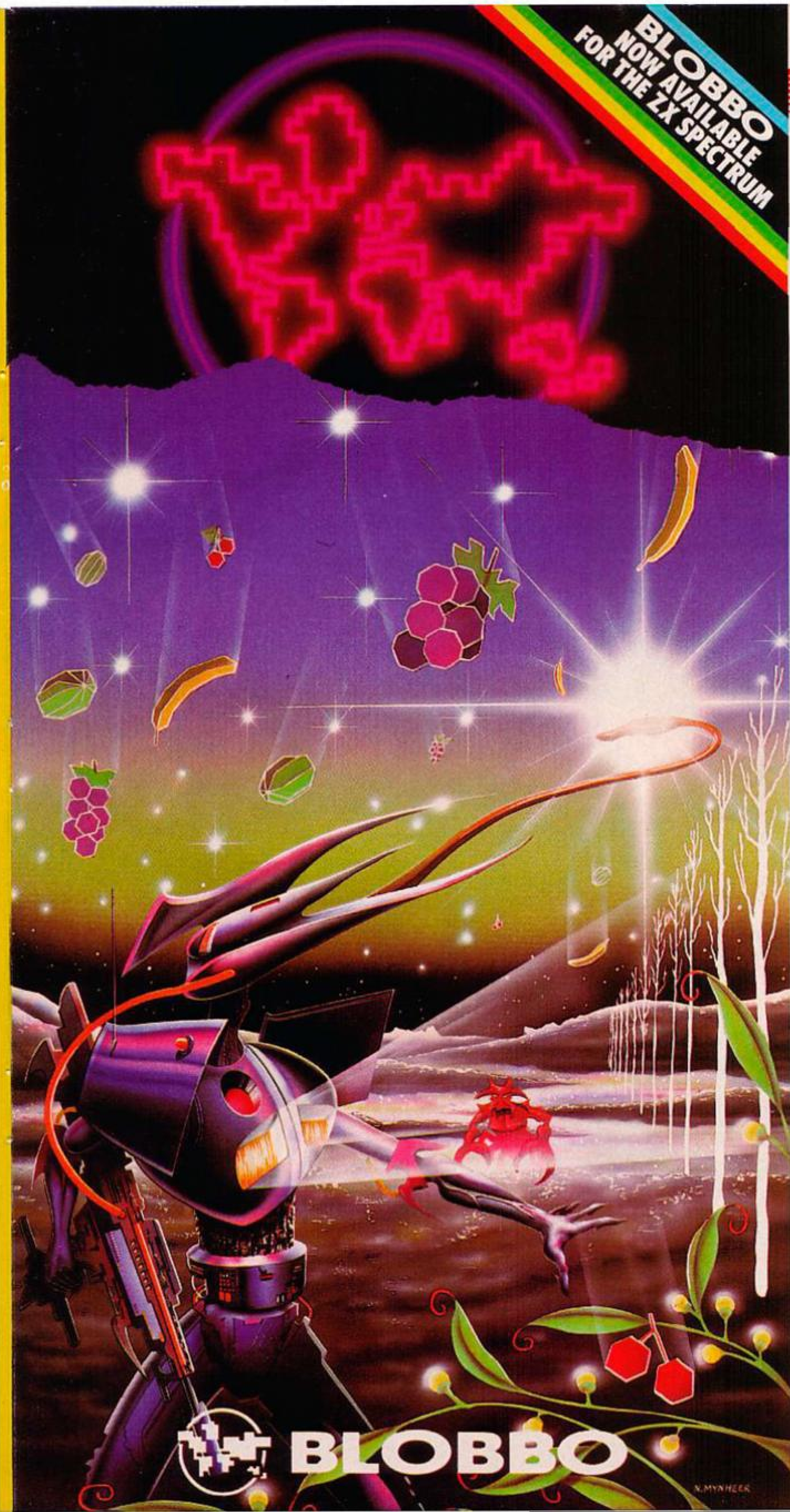

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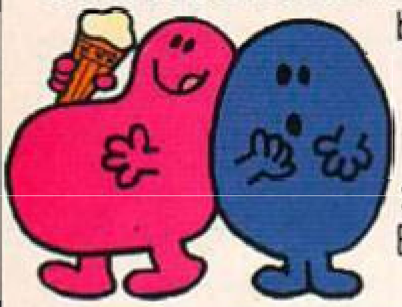

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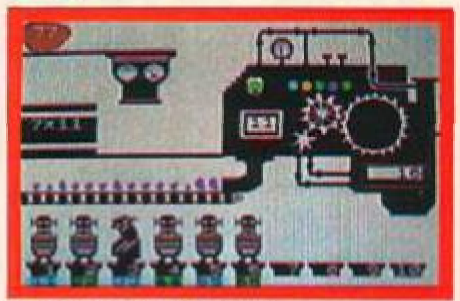

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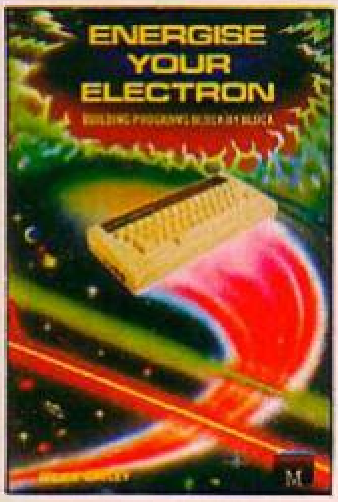

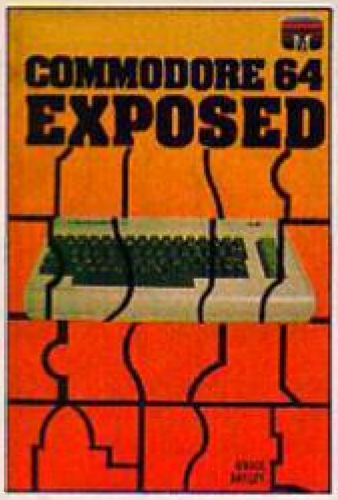

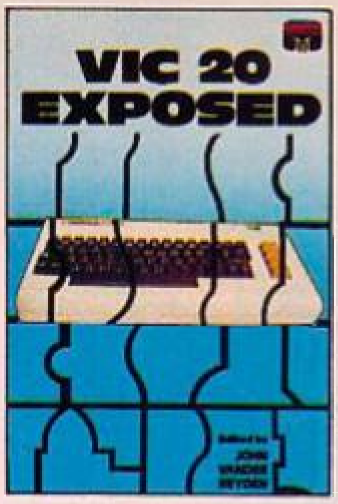

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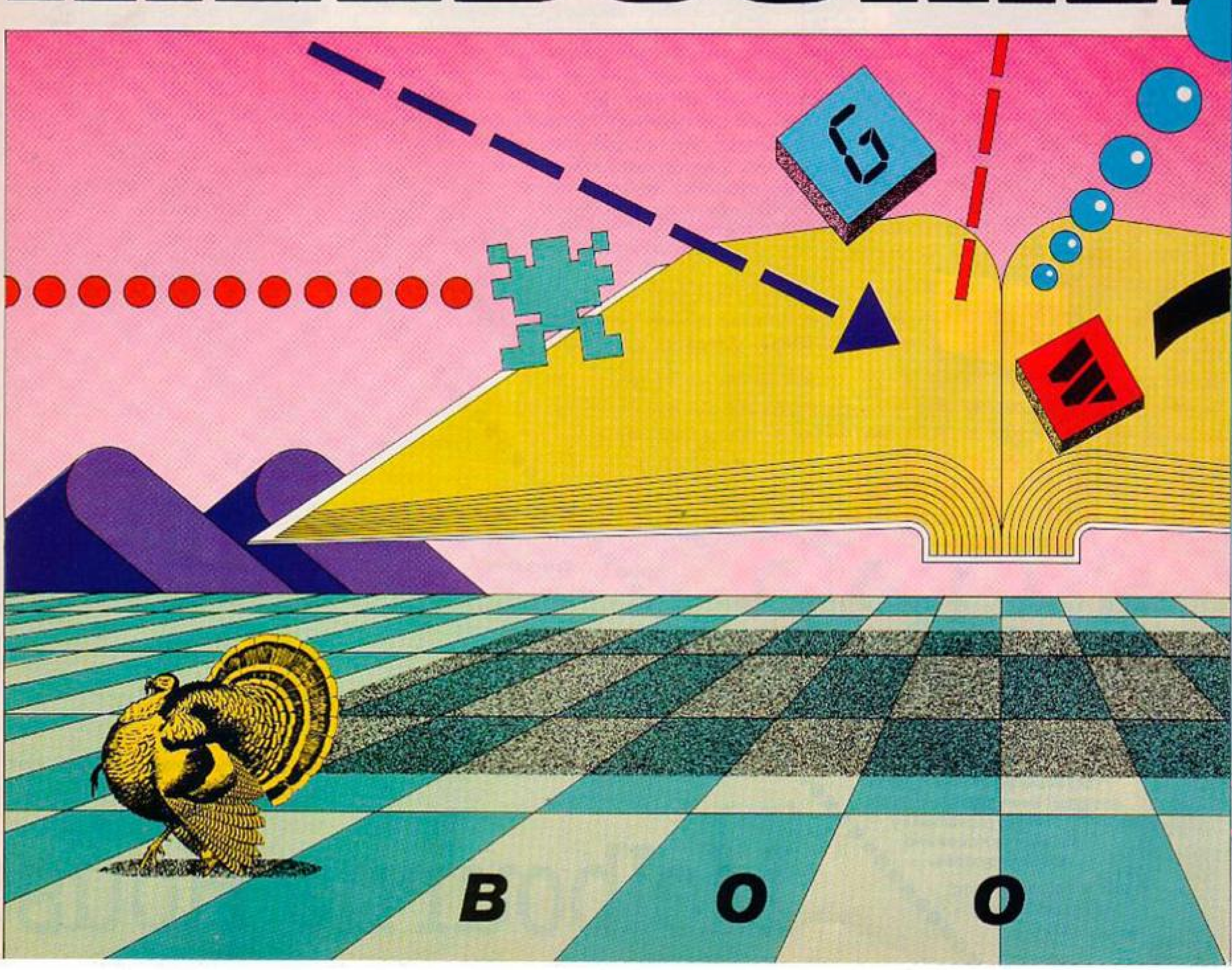

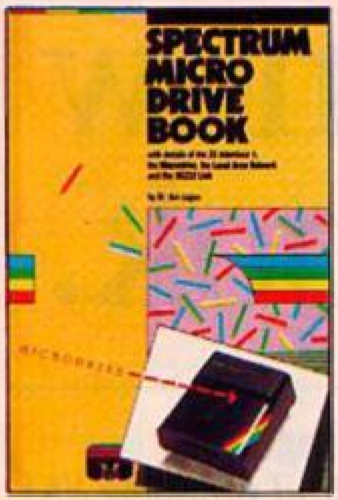

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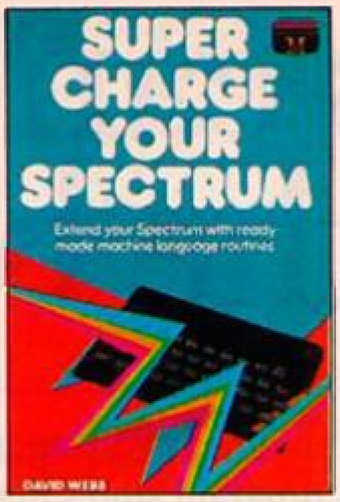

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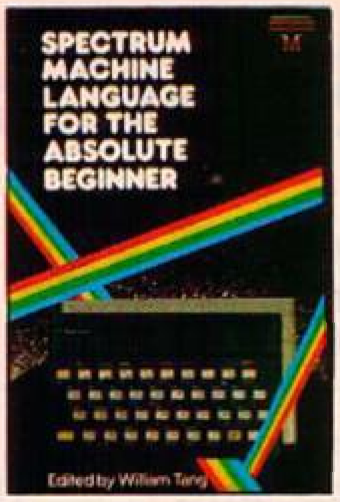

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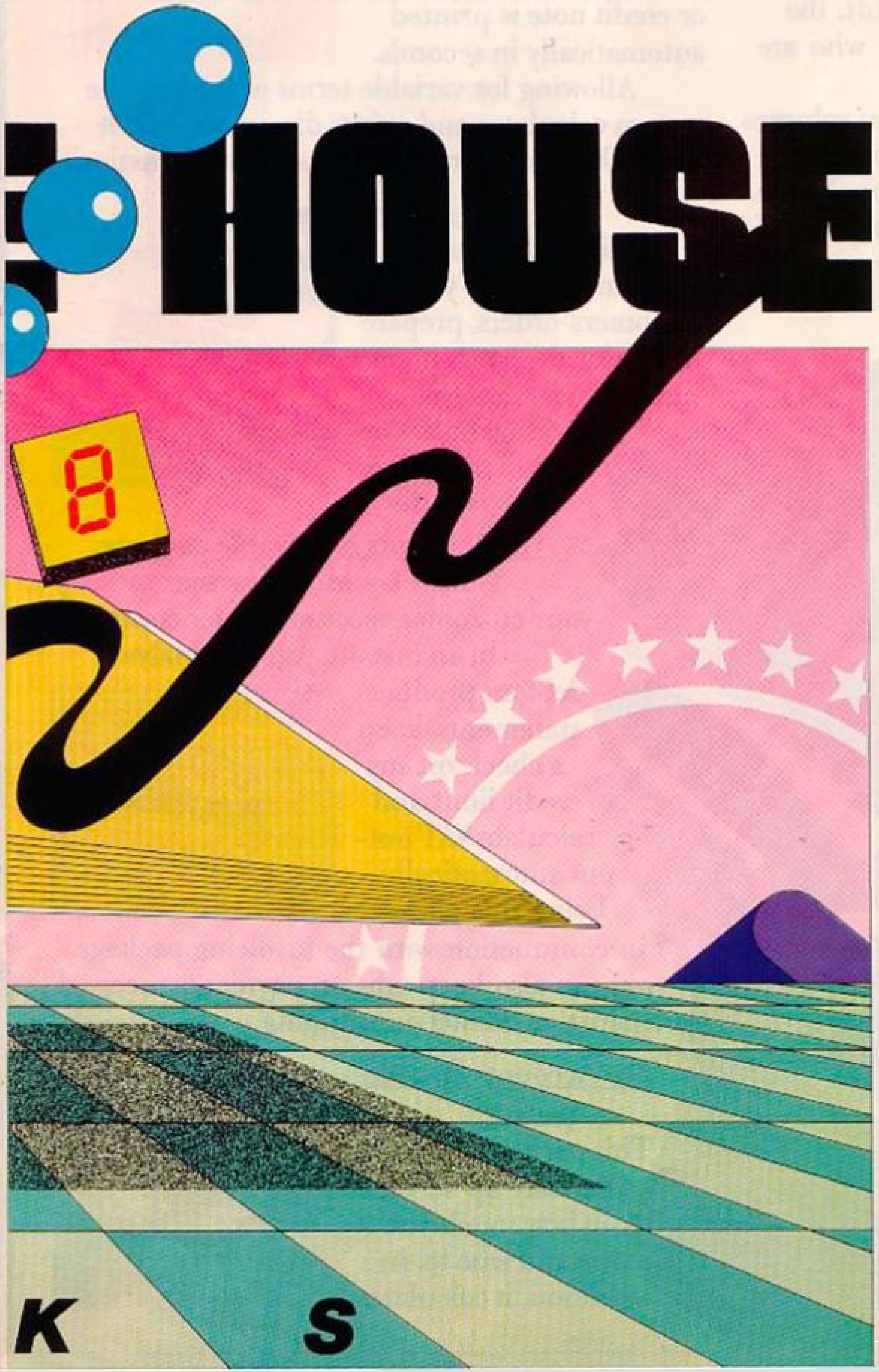

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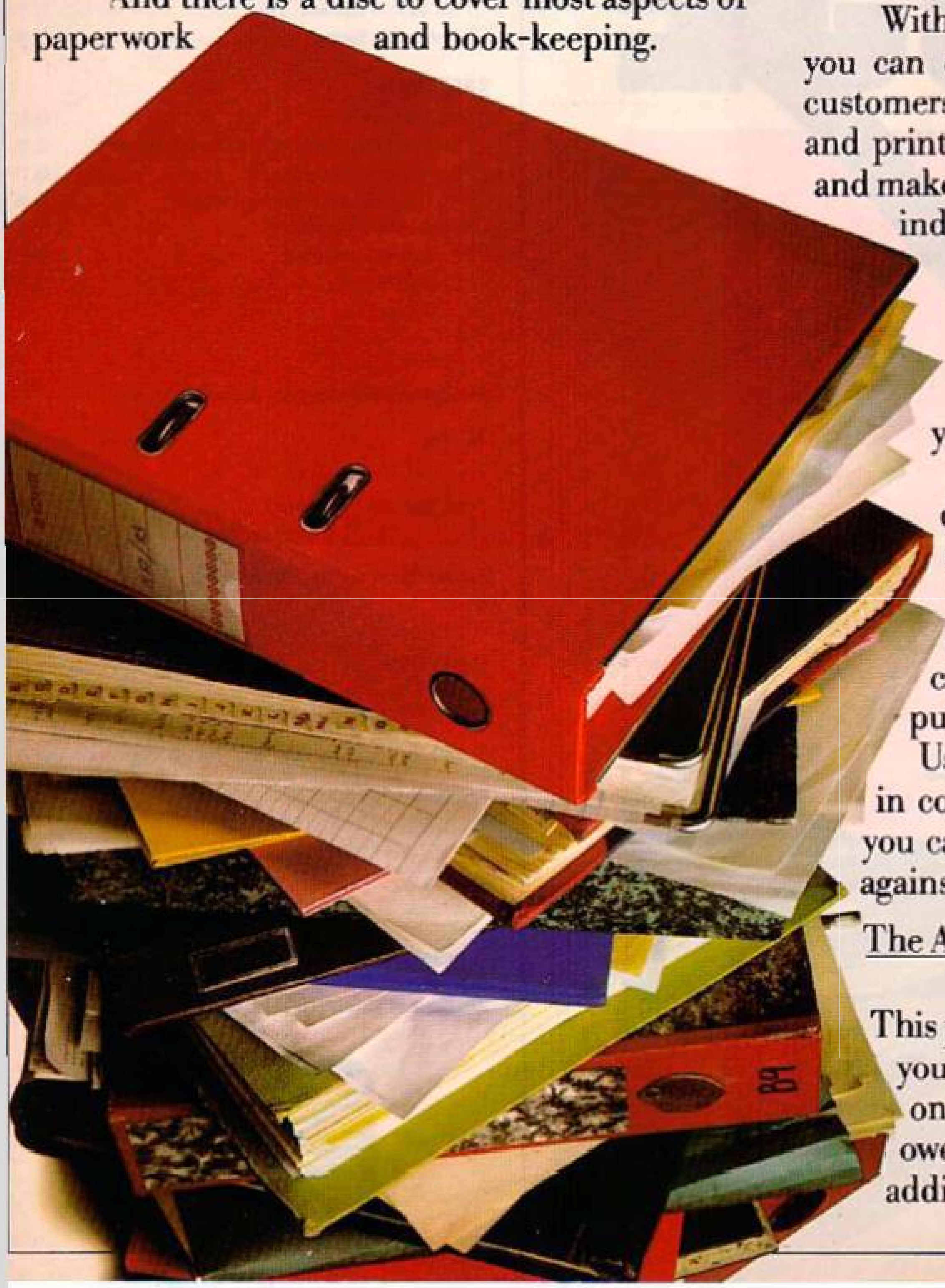

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YOUR LETTERS

A PAT ON THE HEAD FOR LYNX

Regarding your December issue and the review of the 96K Lynx, it seemed strange that the reviewer found the Lynx cassette interface very sensitive to levels. Usually it is found that a recorder volume of half to full volume is successful.

The cassette interface will operate at six different baud rates 600-2100 baud selected by the Tape command. Difficulty may be encountered with the higher baud rates Tape 4 and 5 and good a quality cassette player and tape are required for reliable saving at these rates Tape 3 — 1500 baud — is usually found to be very reliable.

The serial port is mainly for use with printers, a full RS-232 being available on the 128K Lynx. The 128K Lynx which runs CP/M on a 80 character screen — 512 by 248 pixels — also runs Basic 35 percent faster giving a similar speed to that of the BBC Basic and at £445 is very cheap for a machine running CP/M — with a 6MHz Z-80.

I must strongly disagree with Kathleen Peel about the quality of the Lynx keyboard which is of a good quality and I find it hard to believe that she found her typing speed too fast for the Lynx. This is difficult to believe, particularly in Text mode, the mode normally used for entering programs.

The speed is only slow when editing and inserting text at the start of a long line where the line must be completely reprinted when each character is entered.

She complains about the user RAM for Basic programs. Excluding the 32K Ram used by the high resolution colour graphics which includes an alternative green to be displayed instead of normal green when required, we are left with 64K which should be available to the user.

Now I am sure Kathleen Peel realises that a Z-80 can only normally address 64K and if the user requires Basic some of the memory must be set aside for Basic and the operating system in ROM together with systems variables, vectors, pointers etc. in RAM. Thus 38K is left for the user.

But instead of leaving the 24K RAM mopped out by ROM unavailable to the user it has been made available for data storage.

M A Inskip, Stoke on Trent, Staffs.

DRAGON SAVE

I realise that the Dragon manual rarely covers how to save machine language programs so I felt I had to send you the following simple Peeks to work out the necessary starting, ending and execute addresses.

I am afraid that it will only work on games without autostarts such as Planet Invasion or Defense by Microdeal ie., ones which you must Exec to begin.

So here is how to do it. After loading the program type,

PRINT PEEK (487)*256 + PEEK (488)

and then press Enter. This will give you the starting address — take a note of this.

Then type:

PRINT PEEK (126)*256 + PEEK(127) – 1

and then press Enter. This will give you the ending address — take not of this.

Then type:

PRINT PEEK(157)*256 + PEEK(158)

and then press Enter, this will give you the execute address — take a note of this.

Finally type:

CSAVEM"PROGRAM", STARTING ADDRESS, ENDING ADDRESS, EXECUTIVE ADDRESS

and then press Enter and the program should be saved onto a cassette in an awaiting cassette recorder.

Alan Carlton, Bishopbriggs, Glasgow.

SPRITE CHANGE

Listing 5 in my pseudo-sprites article in your January issue — the sprite designer program — needs the following changes to be made to it.

Add these two lines:

```
45 CLEAR 63999 (or 31199 if 16K)
5085 IF N = 0 AND k = 1 THEN
     PRINT AT j,8;
```

Change these two lines:

```
1110 IF IN 64510 = a(6) THEN .
     GOTO 3000
3040 GOTO 1040
```

Robert Newman, Northamptonshire.

ZX DRAW SIN

Although the machine code for my ZX-Draw program in the February 1984 issue was correct, the Sin-table creation program was missing. Without this, the Circle routine will not work correctly. The necessary lines are:

```
100 FOR K = 0 TO 179
110 LET A = INT (256 × SIN
    (2 × PI × K/360))
120 IF A = 256 THEN LET A = 255
130 POKE K + 16885,A
140 NEXT K
```

This should be input and run before attempting to use the Circle routine. Having been run, this program can be deleted and forgotten about, as the Sin-table will be safely stored in the 2 REM line.

Spencer A Collyer, Rugby, Warwickshire.

DRIVE STORE

I am a 14 year old Spectrum user. Thirty five days ago I received my long awaited Microdrive order form through the post. I had read practically every review and article on Sir Clive's Drive and was hell-bent on buying one.

A micracle though it is, my Drive and Interface 1 arrived 27 days after ordering. I attached it to the Spectrum in the described manner and switched on. Ping — miracle, number 2 — it actually worked.

Soon, though, I grew tired of typing in non-sensical little programs and data bases and files. I formatted my blank cartridges and started to attempt to transfer my games software on to cartridge. As there is no facility within the system to transfer programs, I had to develop my own method for this.

First, most professional programs have a Basic leader which handles the loading procedure. These programs can be merged to counteract the auto-run.

When the program is in memory, list it, and change the Load "" Code statements for the drive version. For the sake of simplicity and speed, take out the screen$ if there is one, as it will only be there for 10 seconds or so. Save the Basic program on cartridge with the auto run — if you want.

Next comes the hard part — the machine code. For obvious reasons this cannot be listed unless disassembled and to save it you need two pieces of information about the code — its start address origin and length.

This information can be found by reading the header of the tape. My program prints the name, length and start address. It works by calling the Load Bytes routine in ROM, and Poking the 17 byte header into RAM, this being translated by the computer.

If the start address is greater than 24610 then continue, if not give up — this is because you will be Poking into the Chans or Maps of the Microdrive — the result being a crash.

If all is well, load the program into the Spectrum and save it as Save* "m";1; "name" code X, Y. (X = Origin, Y = length). Then repeat this process for all the machine code blocks and try it out.

Charles Cohen, Totteridge, N20.

```
10 FOR n=32500 TO 32513: READ
a: POKE n,a: NEXT n
20 CLS : PRINT AT 0,0;"Prepare
Header"
30 RANDOMIZE USR 32500
40 PRINT AT 10,0;"NAME--";: FO
R N=32551 TO 32560: PRINT CHR$ P
EEK N;: NEXT N
50 PRINT AT 11,0;"LENGTH--";PE
EK 32562*256+PEEK 32561
60 PRINT AT 12,0;"START AT--";
PEEK 32564*256+PEEK 32563
9000 DATA 55,17,17,0,221,33,38,1
27,62,0,205,86,5,201
```

AUTO START

This method not only auto-starts your machine code programs, but also makes them almost copy proof.

When you type Clear address, the Spectrum puts two bytes at RAMtop. These are Poke address — 3, 3 and Poke address — 2, 19. The contents of address — 1 are always set to zero.

These two addresses point to the address which the computer will jump to when it has finished executing the program — or forced to stop by an error or Break — ie., Jump address = a+b*256.

This is normally set to 4867.

But, if you change the contents of the addresses to form the start address of your machine code, it will auto-run after completion of the Basic. It will also try to execute the code before it is there, if it is broken into while loading.

To do this:

CLEAR address: Let a = (start of machine code): POKE address – 2, INT (a/256):
POKE address — 3,a – 256* INT(a/256)

Demonstration: To execute a routine starting at 4757, as shown below, a typical program would be:

```
10 CLEAR 31003: LET a = 4757:
   POKE 31001, INT(a/256):
   POKE 31000, a – 256*INT(a/256)
```

ANOTHER BRICK IN THE WALL

With reference to The Wall in your January issue, Tom Fiers excellent arcade-style game has a built in difficulty level for keyboard players after the first game. Your star cruiser careers sharply to the right, out of control.

OK we find the trouble, A$ was defined three times — once outside the game loop at the keyboard/ joystick selection. For either use, the program re-enters at line 150, sees the wrong value in A$ and Pokes a 1 to 32049 — joystick — in line 160. Changing A$ in lines 110, 120, 160 to an unused variable is probably the easiest solution.

Error trapping in the machine-code loader can also be improved by the additional line: 75 IF H>255 Then 150.

Edwin M Mott, Wantage, Oxon.

```
20 GOTO 20
RUN
```

On pressing Break, the computer jumps to location 4757 and executes, printing up the message on the screen.

David McGee,
Liverpool.

LANDER CRASH

I am afraid that the program Fast Lander — Software File, February, page 195 — contained some graphics characters that failed to list on the printer. The first statement of line 410 should read:

```
410 LET a$="␣␣EF␣␣GH
␣EF␣␣␣␣I␣␣␣␣␣␣
EF␣IGH␣␣␣␣␣I"
```

when the contents of the string are all graphics characters or spaces. This string holds the Meteors so the game is a bit dull without it.

D L Drummond,
Abingdon,
Oxofrdshire.

CORRECTIONS

The listings for the Spectrum Dracman game are correct but the instructions for entering, saving and running the program need clarifying. So long as you have saved all the Basic programs on tape you should have no problems getting it to run if you follow these steps:

1. Run program 1 and save the code it creates using line 5400.

2. Run program 2. There is no need to save the code it creates since this will be incorporated by program 3.

3. Type in or load program 3 over program 2. You could New program 2 beforehand but do not turn the machine off. Run program 3 and save its machine code using line 9999.

4. Save the code from programs 1 and 3 as one block. To do this follow the procedure given at the start of page 76, ending with Save Code 25088,4911.

5. Run program 4 and then New it. Run program 5 and save the machine code created using line 5200. Ignore the instruction given in the text, Save Code 3000, 2568. This is a misprint.

6. You should now have two blocks of machine code, one from program 1 to 3 and one from programs 4 and 5. Combine them into one block by entering CLEAR 25087: LOAD "" Code: LOAD "" Code. Save them with SAVE "DCODE" CODE 25088,7680.

7. Run program 6 and then delete every line after line 1. Enter line 10 as given in line 200 and save the Basic program using the instruction in line 210. Now save your final block of machine code using line 230.

8. You should now have three finished products, the Basic program 6 consisting of lines 1 and 10, and two machine code blocks. When run program 6 will load in the machine code blocks. Make sure they are stored after program 6 on your final tape. Now change line 10 to read RAND USR 30000. and then enter Run.

Our printer managed to scramble line 710 in the Atari Lair listing. Only the first statement has been corrupted. It should read IF PEEK(632)<>15 THEN BONUS=BONUS+1. The rest of the line is given in the February issue starting with SOUND 2,20 etc . .

Line 780 in February's Freeway Frogger for the BBC was truncated. It should read LDA T,X.

EDITORIAL

WE ARE ABOUT TO be converted. By October the first of the MSX manual-thumping missionaries will have arrived from Japan. From then on the cults of Sinclair and BBC Basics, and any other forms of software incompatibility could be under threat.

Programs can be swapped between any machines that support MSX, Microsoft's software and hardware specification. With more than 50,000 MSX micros a month coming off Japanese production lines already, this new standard appears to be far more than just another promise of software compatibility.

If MSX does manage to gain a foothold the advantages to users are obvious. When you visit friends you will be able to take along a bundle of your Sony programs to try out on their Yamaha. Because the two machines' Basics are the same you will also be able to discuss and sort out the finer points of a programming problem on either computer.

Thanks to that compatibility, books, articles and courses will be equally relevant to each of the 15 or so micros that are being produced by big names such as Sanyo, Canon and Hitachi.

Microsoft also plans to make data discs created under MSX-Dos compatible with IBM's MS-Dos. That could avoid the time-consuming business of rekeying data when you move up to a larger system which uses the IBM standard. Eventually you might even be able to finish a job that you started in the office on the home computer.

Although some of the MSX machines could cost as little £140 when they first appear, many will be targeted at the £200 mark — the British manufacturers' weak spot. The computer that dominates there at the moment is the CBM-64 and consequently it could turn out that Commodore suffers more than any other at the hands of the Japanese.

Availability of software is always what tempers praise for a new machine. The attraction of MSX for computer manufacturers is that they know that any new machine they produce will arrive on the market to find a range of software waiting for it. The real question is whether the programs that have already been written in Japan will be good enough to get the MSX show under way in the U.K. in the first place. Software — and particualrly games software — alwyas has a national slant: for example, the British seem keener on novelty than the Americans.

What will be crucial to the success of MSX micros is how many British software houses are pulled in to write programs for the new standard in its early days. The bait for those program-makers is that even if individual MSX computers only sell in small quantities compared with, say, the Spectrum, all the MSX machines put together could constitute a very large and lucrative software market.

With that kind of threat could the time now be right for Sinclair and Acorn to end their long-running feud and create a competing home-computer standard? Even if that unholy alliance were in the least likely it would probably already be too late. By the time the specification had been agreed and machines built, MSX would be either established or a failure.

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Apple says there are 126K's in Macintosh — plus monitor

AT FIRST GLANCE you could be forgiven for thinking that the £2,000 Macintosh system has little to do with home computers. But one day all micros may look like this.

Just five months ago Apple made it easier for people to interface with micros by introducing the Lisa — a £6,000 computer which simulates a traditional desk full of folders notepads and calculators from which you could choose what you wanted to use by moving a mouse — a sort of upside down trackball — around on your real desk.

Now Apple has put many of those facilities on the Macintosh and is working on a £400 home micro using the same sort of ideas. The Macintosh itself is a real 32-bit 68000 based micro with 128K RAM, keyboard, mouse and all in one monitor and 3in. disc drive unit which looks like a 1950's television.

Wait a moment while I refill your cartridge

WHEN YOU start getting bored with a cassette program you can always erase it and use the cassette again to record some music — but what do you do with an old cartridge? Just take it back to the shop and have it "refilled" with another program if its one of the new Romox cartridges.

Prism plans to put a Romox terminal in every high street store that sells software. Each shop will have a stock of blank EPROM cartridges, which you will be able to buy for about £15 each, and a terminal which can download games and other software straight onto the blanks from a central computer.

The scheme has obvious attractions to Prism who distribute software by road rather than by wire at the moment and, if the cartridges start to edge cassettes out of the market, to the software houses. It is much more difficult to make pirate copies of cartridges than cassettes.

It may be less attractive to computer owners who at the moment if they buy games on cassette can build up a library of games like they would a record collection — and for about the same price £5 or £6 a time.

The Romox refills will cost around £4 to £10 a time but each one you want to keep will cost you £20 including the cost of another blank.

On its own the Casio PB-700 is a smart high-specification portable computer with 4K RAM and an excellent four line liquid crystal display. Add the four colour printer plotter, the microcassette drive and some add-on memory and you have a battery operated go anywhere system for around £400. This makes it cheaper than the comparable Epson HX-20.

Showjumping is for girls

GAMES FOR GIRLS are few and far between but Case Computer Simulations is bringing out a whole series of new programs for the Spectrum under the Games for Girls label. Best of the bunch is probably Hicksted — Mathsted a combination of a show-jumping game and table-tester.

Giving voice to Spectrums

TELESOUND HAS HAD to make its beep booster for the ZX Spectrum even smaller to fit inside the Series 3 Sinclairs. You can, of course, always output the Spectrum's inadequate sounds through a playing cassette recorder but Compusound's Telesound allows you to play it out through the TV for just £10.

Microvitec's Cub monitor is designed specifically for the Spectrum owner who plans to upgrade to a Sinclair QL one day. The Cub 1431/MZ has a built in Spectrum interface card which effectively converts the luminance and chrominance signals at the Spectrum's ports into the RGB/TTL format. When you upgrade to a computer like the QL which has a proper RGB output you can switch the interface out of the circuit and use the Cub as a conventional RGB monitor. At £300 the 1431 is almost twice as expensive as buying a colour TV to use with your Spectrum — although the quality of the picture will be far higher with the Cub and will allow you to upgrade to a computer with 80-column display.

Commodore 264 includes word processing, spreadsheets and filing

BUILT-IN SPEECH AND SOFTWARE are strong points of the 264 and 364 — the first of the so-called Triple Four series of Commodore home computers to follow on from the 64.

Making a mistake when you are programming the 364 could be humiliating because a built-in voice gives spoken error messages — "you forgot to hit the return button dummy" — or words to that effect. First on the market will be the 264, available in the late Spring in America and a little later here.

Although this has 64K RAM like the 64 almost 60K will be available for Basic programming instead of less than 40 on its predecessor. The 264 also has improved Basic, a built-in monitor, screen windows, a choice of 128 colours and a help key.

A range of models of the 264 will have different built in programs on ROM chips. "Commodore is putting more software on silicon than any other company" according to Sig Hartmann of CBM's Computer Systems Division. One of the options will be called 3-plus-1. This includes word processor, electronic spreadsheet, filing system and graphics — very similar to the free Psion software Sinclair plans to offer with his QL.

With the Commodore you will be able to make use of windows to look at the word processor and the shreadsheet simultaneously.

Commodore is also talking about introducing a 128K version of the Commodore 64, and with the 264 likely to cost less than £300 it is not surprising that the company is confident that it will stay as number one in the world home computer market.

Kershaw's secret passion

IF YOU'VE EVER been cheered up by a bumper sticker in a traffic jam saying "I'd rather be surfing" you may like to know that if Nick Kershaw — who is zooming up the charts with his single "Wouldn't it be good" — was allowed a bumper sticker it would read "I'd rather be playing computer chess".

With RHE digitising TV pictures is as easy as BBC

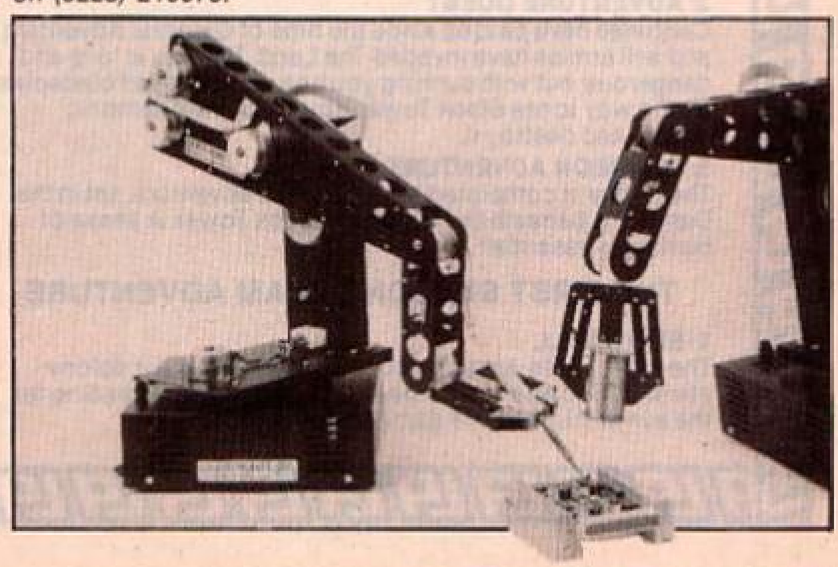
DIGITISING TV PICTURES is one of the most visually exciting applications for computers — but until recently it cost too much for home micros. Now RH Electronics has developed a video digitiser pack for £250 on the BBC Micro which allows you to take pictures straight from a video or camera and manipulate them on screen using a light pen to add details to the picture and blowing up and rearranging sections of the screen.

You can save your finished works of art back on to video tape. The pack consists of an EPROM chip containing the software which plugs into the BBC's spare ROM sockets, a light pen, and a digitiser which is housed in the much-photographed but rarely seen second-processor style Acorn peripheral box.

The digitiser can accept colour or black and white input but can only operate in monochrome with eight different shades of grey. RH Electronics is on (0223) 311290.

Inventing your own computerised cat door is just one of the uses you could put Commotion's little Beasty to. Beasty is an interface which allows a BBC Micro to control up to four servo motors which you could use to open and close curtains to give potential burglars the impression that you are still in the house when you are away on holiday or to control a robot arm or even open a cat door. The next stage, or course, is to add some sensors so the computer can for instance detect when your cat is outside the door and know to open it. At the moment the Beasty costs £50 and the servos £14.50 but Commotion is working on a Super Beastie which will incorporate sensors as well. Commotion is on (01)-804 1378.

Cyber man David Sands was championning talking dashboards years before cars like the Austin Maestro and Renault 11 appeared. Now his company Cyber Robotics is producing precision made one armed robots that will run on the BBC, Dragon, Oric or Spectrum. These Cyber 310s can rotate freely on their bases, pivot through 300° at the shoulder and have double-jointed elbows and wrists. The hand is a gripper, and using Roboforth — Cyber's Forth like language you can control it finely enough to control a soldering iron in case you want to set up your own automated production line. The only snag is the price — £650 for a fully working robot arm with demonstration software. Cyber Robotics is based in Cambridge on (0223) 210675.



LORDS OF TIME

Joins our range of acclaimed pure-text puzzle adventures, at £9.90, for:

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ADVENTURE REVIEWS

"Adventures which have a fast response time, are spectacular in the amount of detail and number of locations, and are available to cassette owners . . I am extremely impressed . . The Level 9 Adventures are superbly designed and programmed, the contents first rate. The implementation of Colossal Cave (Adventure) is nothing short of brilliant; rush out and buy it. While you're at it, buy their others too. Simply smashing!"
- SOFT, Sept 83

"I found Dungeon exceedingly well planned and written, with a fast response. There are well over 200 locations and the descriptions are both lengthy and interesting. The objects number about 100. It could therefore take some months to explore the whole network, giving many hours of enjoyment in the process."
- C&VG, Sept 83

"The descriptions are so good that few players could fail to be ensnared by the realism of the mythical worlds where they are the hero or heroine . . . great fun to play."
-Which Micro?, Aug 83

"My appetite has been whetted and I intend to get my own copy (of Snowball) to play."
- What Micro?, Dec 83

ADVENTURE REVIEWS

"This has to be the bargain of the year. If adventures are your game then this (Colossal Adventure) is your adventure."
- HCW, 5 Sept 83

"Colossal Adventure is simply superb. Anyone who wishes to use adventures in an educational setting really must use and see this program as it emulates Crowther and Wood's masterpiece so well. For those who wish to move onto another adventure of similar high quality, Dungeon Adventure is to be recommended. With more than 200 locations, 700 messages and 100 objects it will tease and delight!"
- Educational Computing, Nov 83

Colossal Adventure is included in Practical Computing's Top 10 games choice: "Poetic, moving and tough as hell."
- PC, Dec 83

"To sum up, Adventure Quest is a wonderful program, fast, exciting and challenging. If you like adventures then this one is for you"
- NILUG # 1.3

"Colossal Adventure . . For once here's a program that lives up to its name . . a masterful feat. Thoroughly recommended"
- Computer Choice, Dec 83

"wholly admirable"
- Your Computer, Sept 83

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A complete, full size version of the classic mainframe game "Adventure" with 70 bonus locations added.

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THE LORDS OF TIME SAGA

7: LORDS OF TIME
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LEVEL 9 COMPUTING

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Please describe your Computer

Yamaha on vibes leads the way to polyphonic YIS-503 cacophony

YAMAHA'S YIS-503 micro is more than just another MSX machine. In Japan it is already available with a plug-in piano keyboard and SGF-01 synthesiser unit with a whole orchestra of built in sounds.

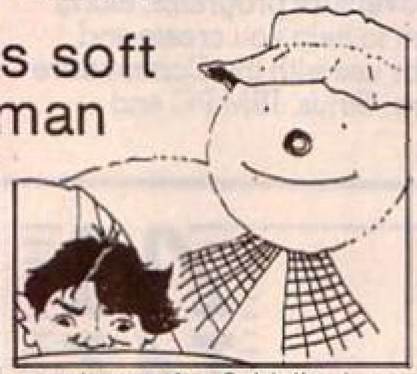
The screen display allows you to switch in any of 20 instruments from horns and bass guitars to zithers, use special effects noises such as raindrops or ambulance sirens set up disco, rock, jazz, swing or even waltz backing rhythms and split the keyboard to allow you to play different instruments with each hand.

In October Yamaha is introducing the 503's big brother — the CX-5 into Britain.

YOUR COMPUTER TOP 20

Game	Company	Machine
Alchemist	Imagine	Spectrum
Atic Atac	Ultimate	Spectrum
Batty Builders	Atari	Atari
Caverns Khafka	Centresoft	Atari
Chequered Flag	Psion	Spectrum
Chuckie Egg	A&F Software	BBC
Cylon Attack	Salamander	BBC
Eight Ball Pool	Microdeal	Dragon
Harrier Attack	Oric	
Hungary Horace	Melbourne House	CBM 64
Inter-national Football	Commodore	CBM 64
Juniors Revenge	Microdeal	Dragon
Manic Miner	Bug Byte	Spectrum
Meta-galactic Llamas	Llamasoft	CBM 64
Planetoids	Acornsoft	BBC
Pyramid	Fantasy	Spectrum
Scuba Diva	Durrell	Spectrum
The Wizard and the Princess	Melbourne House	Vic 20
3D Ant Attack	Quicksilva	Spectrum
3D Grand Prix	DK'tronics	Spectrum

Quicksilva goes soft with the Snowman



EVEN QUICKSILVA'S bloodthirsty Software Manager Paul Cooper has to admit that there's "no death and nastiness" in Snowman — the company's latest release which costs £7 for the 48K Spectrum — based on the Raymond Briggs book. A little boy has four goes to build a snowman, braving the perils of gas flames which can melt the snow he is collecting and warding off sleep monsters with an alarm clock. The worst that can happen is drifting peacefully back to sleep. Quicksilva is considering using other Raymond Briggs characters such as Fungus and Bogeyman and Paul Cooper is quick to point out that Quicksilva is not giving up shoot-'em-ups although the company is not considering making a game out of *When the Wind Blows* Raymond Briggs book about the shoot-'em-up to end all shoot-'em-ups — World War III.

As Cooper says "nuclear war can upset a lot of people."

Personal CP/M first on Adam

WHEN THE COLECO Adam computer system goes on sale in Britain later this spring it will become the first home micro to have Digital Research's Personal CP/M available as an option.

If your micro can run the CP/M operating system you can use any of a whole library of programs written for the hundred different machines which can all run CP/M. The problem is that usually you need a disc drive but Digital has brought out a miniaturised version of CP/M which can fit into a few K of memory and so can be loaded from cartridge or tape.

Digital is producing a tape of Personal CP/M which can be loaded from the Adam's integeral cassette drive.

Brother EP-44 big for 1984

BROTHER is making great play with the idea that 1984 is going to be a big year for the company. It has certainly started in the right way with the release of the EP-44 — a battery powered electronic typewriter which can store three pages of text and double up as an RS-232 computer printer.

Also new is the £180 HR 5 dot matrix printer which come in RS-232 and Centronics versions. Both the HR 5 and EP-44 can print directly onto thermal paper or, using relatively expensive thermal ribbons, onto plain paper. But while the HR 5 has a 9 by 9 matrix print head which gives the traditional dot printer domino effect the EP-44 uses a 24 by 18 matrix to form each character which gives a quality approaching daisy wheel.

The EP-44 has a built in one-line liquid crystal display for error checking and a 4K memory for storing text, which you can call back to edit or feed out through the RS-232 interface to another computer or even connect to an acoustic coupler to use as a makeshift go-anywhere terminal.

The EP-44 costs £220 and Brother is now working on a £300 machine for release later in the year.

Imagine programmers Eugene "Wacky Waiters" Evans and Mike Glover left, and centre left, are hoping that these are the last bugs they are going to find in their forthcoming Commodore 64 game Psycalpse. While Eugene and Mike tackle the Commodore Ian "Zip Zap" Weatherburn, centre right, and John "Zoom" Gibson, right, seem to be experienceing the same sort of problems writing Bandersnatch for the Spectrum. As you may have noticed the Imagine programmers use Sage micros to write the programs which are then converted for the particular machines they will run on. Once the new Sinclairs start arriving Imagine plans high speed games to take advantage of the QL's high speed 68008 processor and 128K RAM.

I could do that...

This month's problem will require you to brush up your 'O' level mathematics or at least some elementary trigonometry. The object is to create an interesting display by rotating a message or a name around the screen. Your program should be able to input a string and then move it in a circle around the centre of the screen.

As the string is printed at a new position the program should delete it at the old position. To make the task more difficult your program should also vary the radius of the circle by a few units every revolution so that the message appears to drift in and out to and from the centre. It should be possible to implement this on any computer with the SIN and COS functions and PRINT TAB(x,y) or its equivalent.

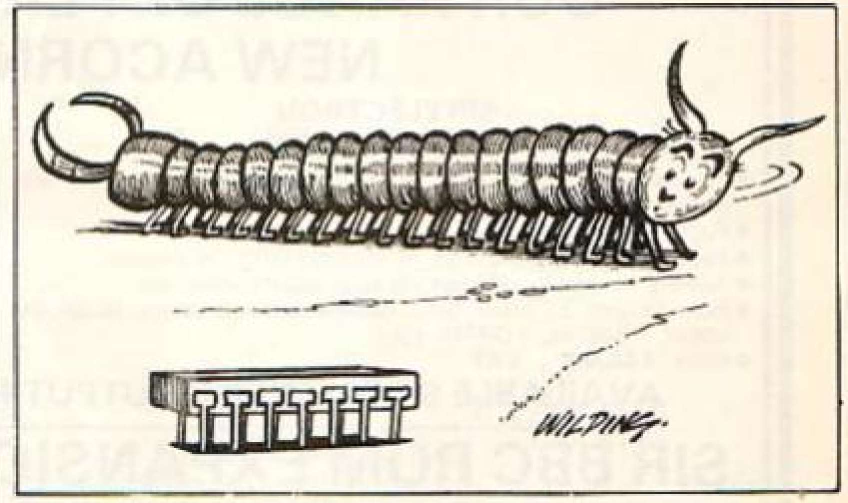
January's problem asked competitors to simulate the processor's interrupt routines in Basic. The entry from Debbie Smith, 34 Brudenell View, Leeds 6, West Yorkshire was judged to be the most deserving of the £15 prize. It runs on the BBC micro and includes counters to show how long each interrupt routine has been running.

```
10 DIM A(4):L=0
15 A$=INKEY$(1)
20 IF A$="B" THEN A(1)=1:IF L<1 THEN L=1
30 IF A$="S" THEN A(2)=1:IF L<2 THEN L=2
40 IF A$="C" THEN A(3)=1:IF L<3 THEN L=3
45 CLS:IF L=0 THEN 15
50 IF L=1 THEN PRINT "BREAK ";A(L)
60 IF L=2 THEN PRINT "SCREEN ";A(L)
70 IF L=3 THEN PRINT "CLOCK ";A(L)
80 IF A(L)=500 OR A(L)=0 THEN A(L)=0:L=L-1
90 IF A(L)>0 THEN A(L)=A(L)+1
100 GOTO 15
```

BEGINNERS first bytes

Starting out in home computing? First Bytes is for you. Just write to *Your Computer* with any hardware or software problems, no matter how small or simple.

Is a 32-bit chip better than 16



SINCLAIR'S NEW QL machine has opened up a fresh can of worms, with its 32-bit, 16-bit or is it just 8-bit processor. Sinclair itself is claiming that the Motorola 68008 chip around which the QL is built is a 32-bit processor, but not everybody agrees. So is it true? And are 16 or 32 bits better than 8 anyway?

The processor chip is the part of a computer which does most of the work. It moves characters from place to place in memory, it alters them as instructed, it calculates, and it controls most of the other parts of the system. On micro computers the processor is physically a single chip, usually the largest chip on the main circuit board. It is sometimes called a microprocessor.

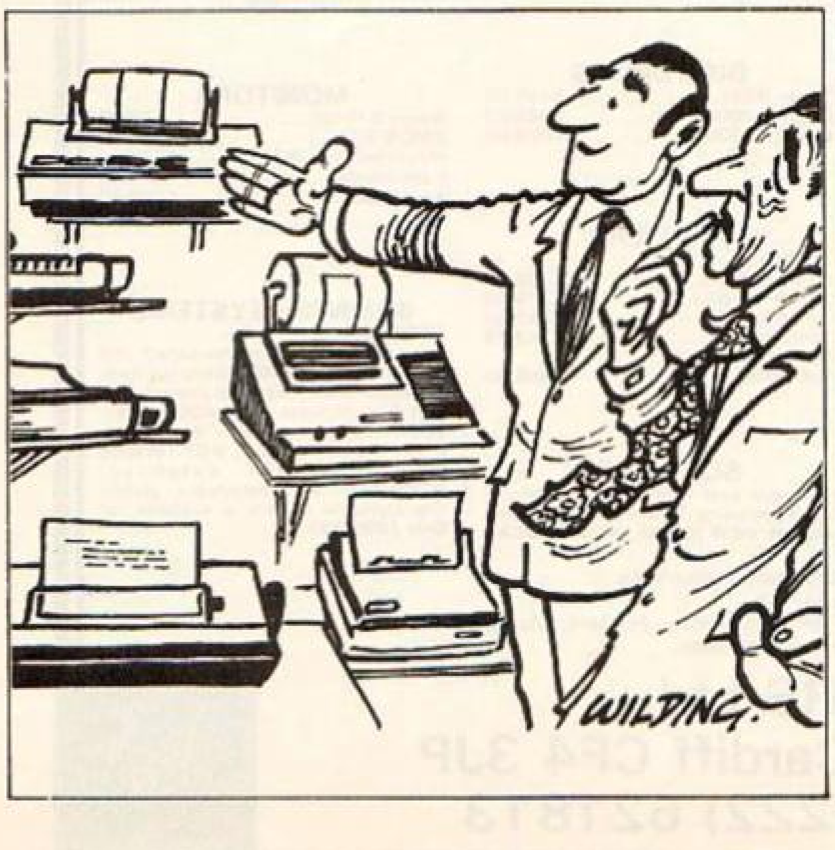
More than any other hardware factor, the choice of processor made when the computer is designed determines the characer of the completed system — how fast it will be, how much extra memory the user can easily add, and often what software will run on the system. Most of all, it will determine how much the computer will cost to build.

Up to now all the successful home computers have been based around 8-bit chips, like the Z-80 in the Spectrum and ZX-81, and the 6502 in the Commodore 64, Vic and BBC machines. The 68008 in the Sinclair QL is undoubtedly a new development, whatever else it is.

Before getting further into this discussion if all you want to do is buy the best machine for your requirements let us admit that you do not need to know about any of this. The best approach is to ignore the hardware spec altogether and look at the software and the price. Does the QL's bundled-in software do what you want it to do? Are the kind of programs you want available, or likely to be available? If the answers are no look elsewhere.

The processor's job then is all about moving data and instructions from one place in RAM or ROM memory to another place in memory, and manipulating them. The speed at which it does this is really what it is all about. The faster the processor

(continued on page 53)



Printer comparison

"I have had a Spectrum for some time now, and have just bought a BBC. Now that I have got a more advanced machine I find I am doing a lot more programming, and my next purchase is going to be a word-processor. The problem is that I do not know very much about pritners except that I am going to need one they are expensive. Can you tell me more?"

THE FIRST thing you ought to ascertain if you are thinking of buying a printer is the purpose for which you want to use it. Obviously, if you are just doing listings and the like you will not need a letter-perfect printer costing several thousand pounds.

The manufacturers do not do very much to help you choose: because makers of cheap daisywheel printers started dubbing them letter-quality — the sort of thing you would be happy to send a letter to your bank with — the makers of more expensive office type printers had to think of something better — hence letter perfect. Matters have become even more confused of late by the makers of high quality dot matrix printers calling them almost letter quality.

So what are the choices? At the bottom end of the market are the narrow paper-roll type printers, which usually take 4.5 inch paper and start at about £100. These are okay for listings, given that the print is of a fairly low quality and is either small at 80 characters per column, or hard to read at 40.

To move up from these makes a sizeable dent in your wallet. The next major type of printer is the full-width dot matrix printer. These used to cost in the £250 plus price range,

(continued on page 53)

Is a 32-bit chip better than 16

(continued from page 51)

gets things done the more things it can do, and the more powerful the system as a whole generally will be.

There are several different factors which affect processor performance. Each can arguably be regarded as the criterium for deciding whether a processor qualifies as a 8, 16 or 32 bit device. But most industry people still accept the data bus width as the key factor.

The data bus is the pathway along which instructions and data move between the processor and RAM and ROM memory. Transfers from one place to another in memory always go via the processor. An 8-bit wide data bus transfers eight bits at a time, a 16-bit wide databus moves 16-bits at a time — so the wider data bus allows twice as much information to go in and out of the processor in the same amount of time.

Other things being equal the processor will do twice as much work. A processor with a 32-bit wide data bus would do four times the amount of work. These numbers are all multiples of eight bits incidentally because eight bits can conveniently represent one character, so it is easiest to organise things around eight bit bytes.

All the existing home micros, with the exception of Texas' late lamented TI-99/4, use processors with 8-bit wide data busses. By contrast many modern office and university level machines use processors with 16-bit data busses, such as the 68000 and the Intel 8086.

The Motorola 68008 is a cut down version of the 68000 with an 8-bit data bus. This is why there is some dispute about the nature of the Sinclair machine.

Opportunity for confusion arises because Motorola really has a family of 68000 processors. The 68000 itself has a 16-bit data bus, the 68008 has an 8-bit data bus, and later this year the 68020 will be coming out with a full 32 bit data bus.

The advantage of the 68008 is cost — not so much the cost of the processor itself but of the other memory and support chips used in the Sinclair machine. The most commonly available low cost chips are organised on an eight bit basis, and these can more easily be designed into a system based around the 68008 version of the Motorola chip.

The Sinclair's 68008 processor does have most other characteristics in common with the more powerful members of the Motorola 68000 family. In particular it has 32-bit wide registers. These registers are the basis for the Sinclair claim that the QL is a 32-bit machine.

Registers are special areas of memory contained on the processor chip itself in which data is manipulated at high speed. Operations on data carried out on the chip are quicker than operations which involve transfers to external RAM chips. It makes sense to hold data on the chip in registers for calculations and other manipulations, rather than continually transferring to and from memory. The number and width of the registers decisively effect how efficiently the system can be programmed at the machine language level.

The Motorola 68000 family, including the 68008, has a total of 17 32-bit wide registers The Sinclair QL is the equal of the Apple Lisa in this respect.

The 68008's register set compares very favourably with the 8 or 16-bit wide registers found in most home computer based on older chips, and 17 registers will be fairly impressive to people familiar with say the 6502. The great advantage of long registers is that fewer machine language instructions need to be performed to carry out the same manipulation.

Machine language programmers also use registers for keeping track of the addresses of data in memory, and big registers bring big advantages.

Another major factor effecting a system's performance is the width of the address bus. This determines how much memory can be directly accessed at full speed by the processor. The larger this figure the easier it is to expand the system, and the quicker the graphic display and add-ons like disc drives generally work.

So-called 8-bit chips like the Z-80 and the 6502 have 16-bit wide address buses, allowing them to address a total of 64K bytes of memory directly. A 24-bit address bus would let the processor directly address 16Mbyte, and a 32-bit address bus lets the system directly address 4Gigabytes.

The Sinclair QL's 68008 and the 68000 both have a 24-bit long address bus, putting them in the 16Mbyte class. With present technology this is certainly an acceptable limit for a home computer.

In fact, the whole 68000 family is designed with the idea that eventually people will want a 32-bit address bus, but 16Mbytes is adequate now for most full scale office computers, and to reduce costs only the forthcoming 68020 is going to have the full 32-bit wide address bus.

The size of the address bus is an extremely important characteristic. It determines how much memory can be easily added to the system. Most home computers built around the Z-80 or the 6502 with their 16-bit address busses, were able to access more than their 64K direct addressing limit, but only by using systems where the processor switched between different banks of memory. With the Sinclair QL and other 68000 family machines this kind of complexity — and delay, is not necessary.

The more memory a system has easily available to it the better because otherwise large amounts of data or programs have to be continually transferred between the available memory and some secondary storage device such as discs. In fact, large memory space is particularly important for home computers, which are often used without discs and which need a fast, colourful graphic display, which also eats up memory.

But probably the greatest glory of the 68000 family is the machine language instruction set. Machine language is the native language of the machine. It not necessary to know anything about it to run software or write programs in Basic. But many computer users get interested in it, and Basic programs are themselves automatically translated into machine language before they are run, so how good the instruction set is it does effect the system's performance anyway.

The QL's 68008 has the same instruction set as the other members of the 68000 family. Each machine language instruction is specified by an op code, which in the case of the 68000 family is 16-bits long. The processor in the typical home micro uses op codes only 8-bits long.

The extra width of the 68000 op codes mean that the number of potential instruction code variations goes up from 256 to over 64,000. This means the machine language programmer or Basic interpreter can specify more accurately what the processor is to do, using fewer instructions. In fact, the 68000 family has a carefully chosen set of just 56 fundamental instruction types, which can be varied in a vast number of ways.

This way the instruction set is both easy to remember and very powerful. To anyone contemplating machine language programming for enjoyment a system based on a 68000 family processor is the thing to get.

Whatever slight bending of accepted terminology Sinclair has used to promote the QL, it is this 16-bit side of the system whih will really sell the machine to anyone who is contemplating machine language programming. Let us coin a new term for Sinclair marketing hype — technological licence — and forgive him.

Maybe the QL is not a 32 bit machine like the VAX minicompuer, but the 68008 chip inside it is the nearest thing to a mini or mainframe that anyone is likely to come across for £400. To the machine language programmer the 68000 is a work of art.

Ian Stobie

BEGINNERS *first bytes*

Printer comparison

(continued from page 51)

but are falling fast, and there will be good quality dot matrix printers available in plenty this year at under £200.

The quality, and speed of dot matrix printers varies enormously. The speed can be as high as 200cps, or as low as 15cps. The quality depends to a large extent on the size of the matrix used. Obviously the larger the matrix the better the quality.

Next stop up in the price range, and the effective ceiling for micro users, are daisywheel printers. Until Juki brought out the 6100 last year there was not a daisywheel under £400. Now people are just beginning to break the £300 barrier. The daisywheel is, by its mechnaical nature, much slower and speeds for affordable ones range from 12 to 20 cps. Beware of what manufacturers quote though, since this tends to be a maximum — deduct 25 percent for safety.

The other important thing to look at when buying a printer is interfaces. Basically, printers either have serial or parallel interfaces, though these go by different names. The most common parallel interface is the Centronics, and the most common serial the RS-232-C.

The Spectrum has serial and the BBC parallel. Serial interfaces tend to be more expensive, but what you can do is buy a serial to parallel converter quite cheaply, and then use the Centronics port standard with most printers.

The last major difference between printers is in the type of paper they will take. The cheapest printers take rolls of paper, and you just tear it off at the end of a listing. Next up is the tractor fed paper, which if you want it to look nice you can tear the edges off when you have finished. It still looks like it's come off a computer though. Lastly there is single or multiple sheet feed. Single feed paper is nice for letters, but is a nuisance for long listings. For the home user a printer with tractor feeds that also takes sheets is the optimum, but expect to pay a little more for the luxury.

Robert Norton.

If you have anything of interest to tell us about your computer club why not contact us on 01-661 3144.

Local news

Acocks Green

A small group meets each month on the third Thursday in the side vestry of St Mary's Church Acocks Green, Birmingham. Micros include BBCs and an Atari 800. The organiser, Mike Bedford-White also runs a games-orientated club at Stonehall Adult Education Centre every Monday. For more details, telephone 021-7073100.

Portsmouth

The Portsmouth Co-operative Computer Club are keen to increase membership with a view to extending the facilities they can make available to members. They are aiming to join Micronet 800. For details of places and times telephone Adrian May on 0705-820339.

Costa Blanca

If you're on the plane to Spain, there's a welcome at the Costa Blanca Computer Club for visitors. Old magazines for the club library are especially wanted. Contact Ed Kelly, Montebello, 25 La Nucia Alicante, Spain. Telephone (965) 32 88 18.

Southgate

Southgate Technical College Computer Club meets at Room B106, fortnightly on Wednesdays at 7.30pm. Contact Kevin Pretorius on 01-997 8986.

Darlington

Darlington Computer Club normally meets weekly, but events are less regular during the summer. Technical library is provided. Contact Leslie Boxell, 8 Vane Terrace, Darlington DL3 7AT. Telephone: 0325 467766.

COMPUTER club

Paul Bond ferries his way from Portsmouth to Gosport to see the Coxes and hear their dream for the future of micros in education.

GOSPORT

The Commodore Computer Club in Gosport meets on the first Friday of every month at Bury House, Bury Road — just a short journey by ferry acorss the harbour mouth from Portsmouth.

Chairman Bryan Cox runs a tight ship, so the evening's affairs were already well in hand by 7.30 prompt. An ex-policeman, now a teacher at the local comprehensive school he has been involved in education for some years, and holds a long allegiance to Commodore products. He is still the proud owner of one of the original PETs, as well as the more up-to-date CBM-64 used primarily by his son. Tony Cox is the club secretary, and can look forward to a bright future at Brighton Polytechnic, studying computer science. He and his father have been working on developing educational software for the CBM-64, largely in the field of teaching foreign languages.

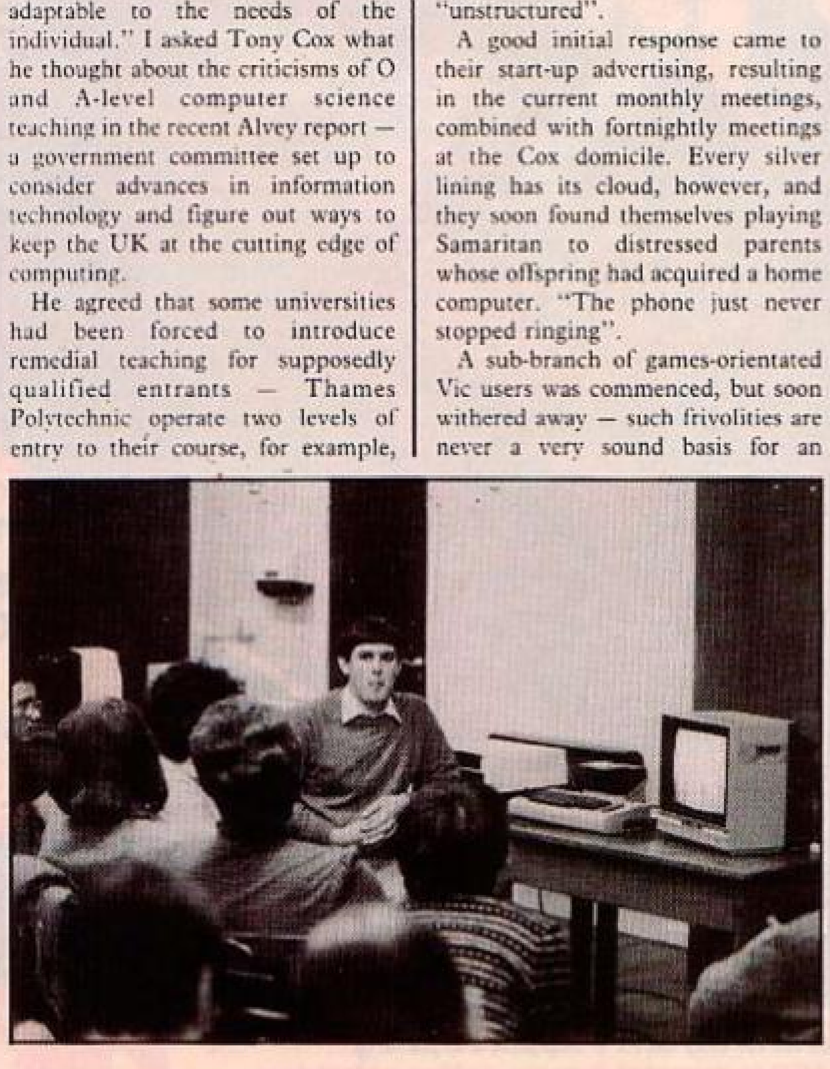
"One-off programs are no good", emphasised Mr Cox. "You must have different levels of complexity within a program, so that it is adaptable to the needs of the individual." I asked Tony Cox what he thought about the criticisms of O and A-level computer science teaching in the recent Alvey report — a government committee set up to consider advances in information technology and figure out ways to keep the UK at the cutting edge of computing.

He agreed that some universities had been forced to introduce remedial teaching for supposedly qualified entrants — Thames Polytechnic operate two levels of entry to their course, for example, but pointed out that some knowledge must be better than none at all.

The Coxes founded the Gosport club, which has a thriving active membership of between 20 to 40, because having visited other local clubs intensively about four or five years ago, they found them too "unstructured".

A good initial response came to their start-up advertising, resulting in the current monthly meetings, combined with fortnightly meetings at the Cox domicile. Every silver lining has its cloud, however, and they soon found themselves playing Samaritan to distressed parents whose offspring had acquired a home computer. "The phone just never stopped ringing".

A sub-branch of games-orientated Vic users was commenced, but soon withered away — such frivolities are never a very sound basis for an enduring computer club. That is not to say that the more stoic users have not also drifted away; but in their case it has usually been to become heavily involved in commercial programming. The club has done its share of straight lectures, demonstrations and London visits.



Forthcoming lectures will concentrate on the use of home computers for business purposes and, later, music. On the evening of *Your Computer's* visit, the scheduled lecturer was incapacitated, but club secretary Tony Cox stepped ably into the breach with a talk on the Commodore CBM-64's sprite facility, and a demonstration of a program for creating and defining your own sprites.

Other activities at the club include a certain amount of swopping of tapes, books and magazines although Mr Bryan Cox will countenance none of the more nefarious copying activities that so many clubs are rumoured to engage in.

Mr I Lloyd, the Conservative member of Parliament for Hampshire is felt to have pushed the area rather a lot in the microcomputer field, which means that the local schools are benefitting greatly from the government's microelectronics in education schemes. But this is not enough, pointed out the club chairman — programmers are essential in education. This would be the beginning of better personal tailoring of educational programs. "I have a dream," said Mr Cox, "that one day I'll be able to individualise all my teaching."

SOFTWARE Shortlist

Star★ chart

Oblivion

BBC B:
Invader type:
Bug Byte:
£7.50

★ ★ ★

A two player game with pretty invaders which mutate, a change from "run of the mill" games. This game is easier than some and enables the less than "whizz kid" to play.

Defender

Vic-20:
Shoot-'em-up:
Atarisoft:
£19.99:

★ ★ ★

One of the first batch of games written by Atari for other home computers, this cartridge enlivens the unexpanded Vic no end, producing a game comparable with Acorn's Planetoids, but not quite as smooth-scrolling. Landers, bombers, baiters, pods and swarmers, the gang's all here and determined to take the humanoids away from it all. You can defeat them, but the captured humanoids have been mutated into killer mutants. At £20 a throw it's cheaper than the £30 an Atari user would pay for the same program, but perhaps you'd rather buy a RAMpack.

Centipede

Vic-20:
Shoot-'em-up:
Atarisoft:
£19.99:

★ ★

Get out your bug blaster and save that fungus! Sorry, guv, but at the price, this is not one of the Atarisoft games for non-Atari machines that I would recommend. Nevertheless, there is plenty of life in the old mushroom patch: frenzied fleas — 200 points; scurrying scorpions — 1000 points; jumping spiders — 300-900 points depending on range; and 100 points for each head segment of the centipede that you zap. Although the documentation exhorts you to save that fungus, you score points for destroying mushrooms as well. A typical example of Atari overkill.

Scuba Dive

- *Spectrum 48K*
- *£5.50*
- *Durell Software*

★ ★ ★ ★

I ADOPT MY BEST stage French accent and usher you into a blue world of terrible submarine beauty where crystalline grace moves side by side with sudden white-jawed, or many-tentacled death.

Jacques Cousteau was never like this and even the famous French submariner would have his work cut out dealing with the denizens of the deep which inhabit Durell Software's latest program which has truly spectacular graphics.

You play the part of a scuba diver. The purpose of the game is to increase your score by collecting pearls from oysters and clams which live on the seabed and the undersea caverns. The scuba diver's legs thrash away realistically, and in the background, sharks slide sinisterly towards him. Not only do you run the risk of encountering the great blue and the great white, but also the great pink — a disturbing sight for any ecologist, usually indicating that the local nuclear power station has been taking some short cuts in waste disposal.

When the diver jumps out of the boat he has to be careful not to fall foul of the Portuguese man-o'war that is invariably lurking below. Most everything swimming around down here, normally so inoffensive when encountered in a sea-food restaurant, spells instant loss of a life if you bump into it, including the rocks.

Further down you discover an octopus guarding the entrace to an undersea cavern. Whereas up to now you have only been collecting pearls from oysters, at these depths the greater pressure has mutated them into clams — giant ones, even more dangerous than the oysters. This is one shell you won't come out of.

Further down again you encounter another cephalopod which blocks the way to another cavern containing treasure chests and giant clams. Where this game differs from the recently released Neptune's Daughters, by English Software for the CBM-64, apart from being less irritating to play, is that you don't have a spear gun to defend yourself with. So you are dependent on agility rather than brute force to roll up your score.

The keys selected on loading are Z to rotate anti-clockwise, X to rotate clockwise, Space to move forward and accelerate to full speed, and Symbol Shift to move forwards and decelerate to stop. After pressing K, you must press the key you wish to use for each direction as it appears on your screen. This means that the game can be programmed for use with most joysticks.

Revenge of the Mutant Camels

- *Commodore CBM-64*
- *£7.50*
- *Llamasoft*

★ ★ ★ ★

IT MAY BE A cliché to talk about the Commodore 64's graphic capabilities, sprites and all that, but here is a game that makes having a CBM-64 worthwhile. A shoot-em-up par excellence, this is the sequel to Attack of the Mutant Camels. Written by Jeff Minter, who seems hell-bent on establishing himself as the Jean-Luc Godard of computer programming, the game features smooth scrolling graphics, 42 different screens and apalling in-jokes and self-referential pastiches. You will either love it or hate it.

You may remember that Minter's seminal work "Attack of the Mutant Camels" cast the unfortunate dromedaries in the role of innocent creatures, kidnapped and irradicated by the evil Zzyaxian Empire. The 90 foot high, neutronum-shielded laser-spitting death camels which resulted have, in the sequel, revolted against their masters. You control the one leading the rebellion.

Your camel can bounce up in the air, crouch down and, naturally, spit death. This is essential as it is continually assailed by a succession of surrealistic objects like portaloos and telephone-boxes. The backdrop to this dadaistic deluge includes some pyramids with blinking eyes, palm trees etc., alternating with a futuristic city in the distance.

We are informed in the opening titles, which would put MGM to shame, that the eminence grise of Llamasoft took two months to write this anatomy of chaos and that he owes a vote of thanks to his dog for not chewing his floppy discs. "I like camels really; I got nothing against sheep either; llamas are llovely" proclaims the screen, in order to forestall complaints from the Animal Liberation Front.

Before each wave you are exhorted

(continued on next page)

Star★chart

Astro Fighters

Unexpanded Vic-20:
Shoot-'em-up:
£6.95:

★ ★ ★

A two-player space duel. One player uses the joystick, the other the keyboard. This is not bad for the unexpanded Vic, and is certanly value for money. The fighters spin and shoot at each other in the style of asteroids in various spacezones. You can shoot down your enemy by firing into a flock of cosmic spiders, creating a grid of energy, or you can edge in and out of a square purple forcefield, dodge rotating blobs spewing out energy beams or pursue each other through a maze. You can select a time period of one to nine minutes at the start of each game. Points are given for each ship destroyed.

Zalaga

BBC B
Aardvark Software
£8.90

★ ★ ★ ★

A flawless copy of the arcade game of the same name. Written by Orlando the pseudonymous author of Acornsoft's Arcadians, Zalaga is a far more interesting variation on Galaxians than his previous game. If you play well a queen bee rewards you with a twin cannon giving you awesome fire-power.

Lost In Space

16K Oric-1
Adventure
Salamander Software
£9.95

★ ★

We ran this on the Oric Atmos, and it seemed to load successfully. Having uncovered the secret of the Franklin's tomb — part one of the Dan Diamond series, you are suddenly beamed through space.

Someone should tell Salamander that it's just not true that their program accepts "Go W." It said this on the documentation for the Dragon 32 implementation of Franklin's Tomb, and it wasn't true, and it's not true on the Atmos either.

SOFTWARE *Shortlist*

(continued from previous page)

to "Stand by your beast". You can go through the attack waves from 1-42 or have them at random. Wacky Whackers confronts you with an all-out assault by flying walkings sticks, the Aggressive Australian Alpinists thrusts you into conflict with kangaroos on skis, Haven't We Met Somewhere Before is a Defender pastiche, and Attack Of The Mutant Camels is over-doing it.

Radioactive Remains has things parachuting from the sky and turning into gravestones, and coupling this with This Kiosk Is A Nuclear Free Zone, we must question Minter's ambivalent stance on nuclear war, you shoot up falling CND emblems and push telephone boxes out of the way. Is he perhaps a covert reader of Robert A Heinlein's reactionary science-fiction books.

Musical reaction is well to the fore in Careful With That Axe, Eugene — the title has definite Floydian undertones and is doubtless a chortling sideswipe at Eugene Evans, one of Imagine's star programmers. Minter has often claimed in the past that listening to Genesis has kept him "sane". As the axes and Eugenes rain down on you, you may speculate that Genesis have their uses, or alternatively that they have so warped their listeners' sense of reality that they should have been put to the sword with the rest of them back in 1977.

A truly mind-expanding game in all, and we must give Mr Minter credit for thanking the man without whom none of this would have been possible — the man who invented the sprite.

Dancing Feats

- *CBM-64:*
- *£6.95:*
- *Artic:*

★ ★ ★ ★

THE CBM-64's facility for making music is second to none and there are already a number of programs which help you make the most of it. But by and large these call for at least a smattering of technical knowledge — you will probably need to understand the difference between attack and decay or a sawtooth and a triangular wave. The beauty of Artic's Dancing Feats is that anyone can use it; to produce pleasing sounds you only need to be able to wield a joystick.

Dancing Feats lets you play the CBM-64 like an instrument using the joystick. The program generates a sequence of chords as a backing while you lay down a melodic line on top. Moving the joystick up and down or left and right produces individual notes while circular motion creates a riff of melodic sounds. To accompany this the program displays the notes on the screen as a series of coloured bars, rapidly rising and subsiding.

What prevents this from resulting in a cacophonous din is that the program ensures that you stay in tune, by transposing the notes to match the key you are playing in.

Before you start you are presented with five sub-menus which give you a choice of beat, bass, sytle, tempo and ending. The bass sub-menu, for example, offers the choice of a jazz, rock, blues or boogie woogie backing while the beat options are coll, beguine, syncopated or dance.

There is also an option to play without the band and take a solo spot. You can then save your composition to tape.

All in all this is an unusually friendly and accessible program. Even if you have a tin ear Dancing Feats will let you indulge the fantasy of sitting in on a jam session. It should prove a boon to musicians manqué.

Air Strike II

- *Atari 400/800/600XL/800XL*
- *£9.95*
- *English Software*

★ ★ ★

NOT BAD FOR ten quid odd, when you consider how much you can pay for sof w re for machines that do not have the Atari's graphic capabilities. This is Scramble with a new twist — you can take your pick of two underground caverns, after you have battled your way through the surface defence.

Having said that, battling your way through the surface defences is no easy task. The anti-aircraft missiles come thick and fast. You will need to muster all your powers of co-ordination in order to win through. The speed of your fighter and the whole momentum of the game are controlled by your joystick's right and left movement. Bombs are dropped by using the space bar or the joystick. To bring the joystick into play as a release mechanism, press the T key. This means you can drop bombs by tipping the joystick forward slightly as you fire the missiles.

If you survive the AAMs and do not nose-dive into the planet Cyclon while unleashing your cargo of death you will progress through five different sectors. As usual, you replenish your supplies of fuel and ammo by destroying the respective dumps. At any point in the game you can take a breather by pressing Ctrl and 1 simultaneously. You receive bonus points on the completion of each sector.

Each cavern has gates that can close on you unexpectedly — these are described as munching caverns — and the added feature of a long-ranged radar at the base of the screen is another stylish touch.

Should you become bored with the intricacies of the program landscape — this is difficult to imagine, it is very convoluted — the company offers you extra landscapes to load into your Airstrike II program. These come on extra data cassette costing £4.95, or alternatively there is an Airstrike II data disc with four brand new landscapes for £6.95.

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ZX81 owners must be prepared for the shock of coming face to face with the T. Rex that leaps out from '3D MONSTER MAZE'. '3D DEFENDER' takes you out of this world and plunges you into space in a fast moving game to defend your home planet against alien spacecraft in a blitz of explosions, plasma blasts and photon beams.

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The crystal ball

The mist clears and I see a new Adventure from Melbourne House coming for the Spectrum and Commodore 64. Based on the Sherlock Holmes stories, it will enable you to interrogate suspects. Naturally, Watson and Inspector Lestrade are on hand to help — or hinder? The globe swirls milkily and I can make out several new ones from Level 9 — The Time Lords should be with us now while Return To Eden and The Worm In Paradise are on their way.

A blue flash in the crystal tells me that Waxworks and After The Fire will soon be available from Digital Fantasia and Channel 8. Look to these pages for more information in the coming months.

A helping hand

Adventurers experiencing problems with any part of any adventure are invited to let me know. Hints and tips will be published in this column to assist such pitiable travellers. Since many adventures I have taken part in have proved traumatic, some have been deliberately blotted from my mind! I will therefore also be calling upon the more successful and less soul-scarred adventurers to write in with their solutions to such problems.

To start the mossy stone rolling, here are two tips, the first for Psycho II, the second for Snowball. They are written backwards so as not to inadvertently catch the eye of any adventurer who prefers to press on without them. To obtain a certain implement:
TEKSAB YRDNUAL FO ESAB REHTAEL TUC

To obtain a certain code:
KNIRD A AIK SRM EVIG

Let us hear from all you adventurers out there soon. Yours in Pit and Peril,, HUGO NORTH.

Snowball

■*Atari, CBM-64*
■*£9.90*
■Level 9 Computing

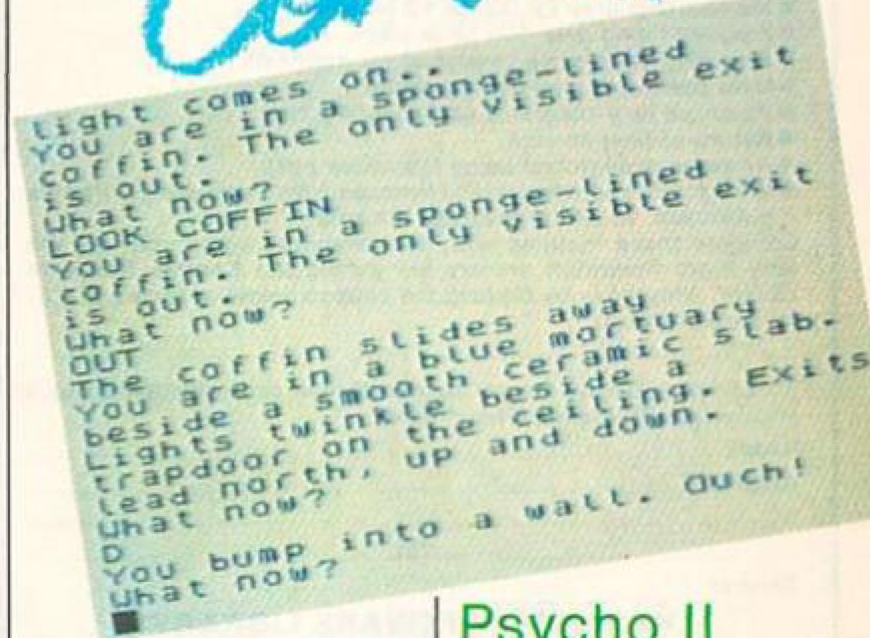
THOSE ADMIRABLE people at Level 9 Computing have released Snowball, a huge text-only adventure available for a wide range of popular home computers.

These adventures use clever text-compression techniques which result in a large number of very detailed descriptions — none of your single-line brevity here. The program is entirely in machine code so there's no thumb twiddling while the computer apparently goes away for a long think about your latest input — response is instantaneous.

Snowball 9 is a five-mile long, 7,000 roomed space transporter. As Kim Kimberley, secret agent extraordinary, your mission is to safeguard the ship against sabotage or catastrophe.

When you are awoken prematurely from suspended animation, you know something must be seriously wrong. The fate of two million passengers lies in your hands.

With an extensive vocabulary, many locations and a large number of puzzles to solve, Snowball should keep you brainstorming for many weeks — thank goodness there's a Save and Restore game feature. This is another imaginative, massive-scaled, immensely enjoyable adventure from those experts down at Level 9 Computing.



Streets of London

■*CBM-64*
■*£9.95*
■*Supersoft*

THERE ARE NOT that many adventures that produce giggles as opposed to thrills but Streets of London is one of them. A text-only adventure for the Commodore 64, Streets of London has a totally surreal plot and is quite unlike any other adventure

I've ever played.

In how many other games have you been mugged by old ladies or been chased by a group of Australians in Earls Court? When did you last come across such unlikely objects as cans of Fosters lager, a ferret, a pointed stick and a machine gun? In which adventure have you met such a motely bunch of characters as Doug Piranha, a skating vicar, the church police and Queen Victoria?

The responses given to such stock commands as Help and Score are completely daffy and entirely useless — but they are funny. Well, funny to those who like the Monty Python style of zany humour.

If the Python style is your cup of tea, then you should get quite a few giggles from this unusual adventure, not to mention a fairly tough challenge. A final note of caution — like the Monty Python brand of humour, this adventure could possibly be described as a little "over-the-top" in one or two laces, although I personally found nothing to object to — I loved it. At the time of writing it is only available for the Commodore 64 but there will be versions for other micros in the near future.

Psycho II

■*Oric-1*
■*£7.95*
■*LA Software*

HERE'S AN adventure to set Oric owners' spines tingling and nerves jangling. You have learned that there is some treasure tucked away in an old house — pretty standard stuff, eh? The catch is that the house is none other than the one where that well-known psychopath, Norman Bates of Psycho fame, used to live.

Unluckily for you, he has murdered his guard and escaped from the asylum where he has been incarcerated for the past 15 years. I will give you just one guess where he is making for.

Psycho II is mainly text with the addition of suitably creepy sound effects. You have to unravel the puzzles and find Norman's hidden hoard — before Norman finds you.

Mad Martha II

■*Spectrum 48K*
■*£6.95*
■*Mikro-Gen*

AS ITS NAME SUGGESTS, Mad Martha II is the sequel to the earlier Spectrum game.

Holiday time sees Martha and Henry in Barcelona, in a hotel where Martha's half-cousin, Manuel, is a waiter, Martha is out for the afternoon on a bus tour and has instructed Manuel to watch over Henry. Henry has plans — he intends to look up an old friend at a secret rendezvous. However, the best laid plans, etc.

The adventure is text based, with graphics for the locations and a few simple arcade-type games thrown in for good measure.

Although the game is fairly simple and unspectacular, it has a certain wackiness about it that is appealing.

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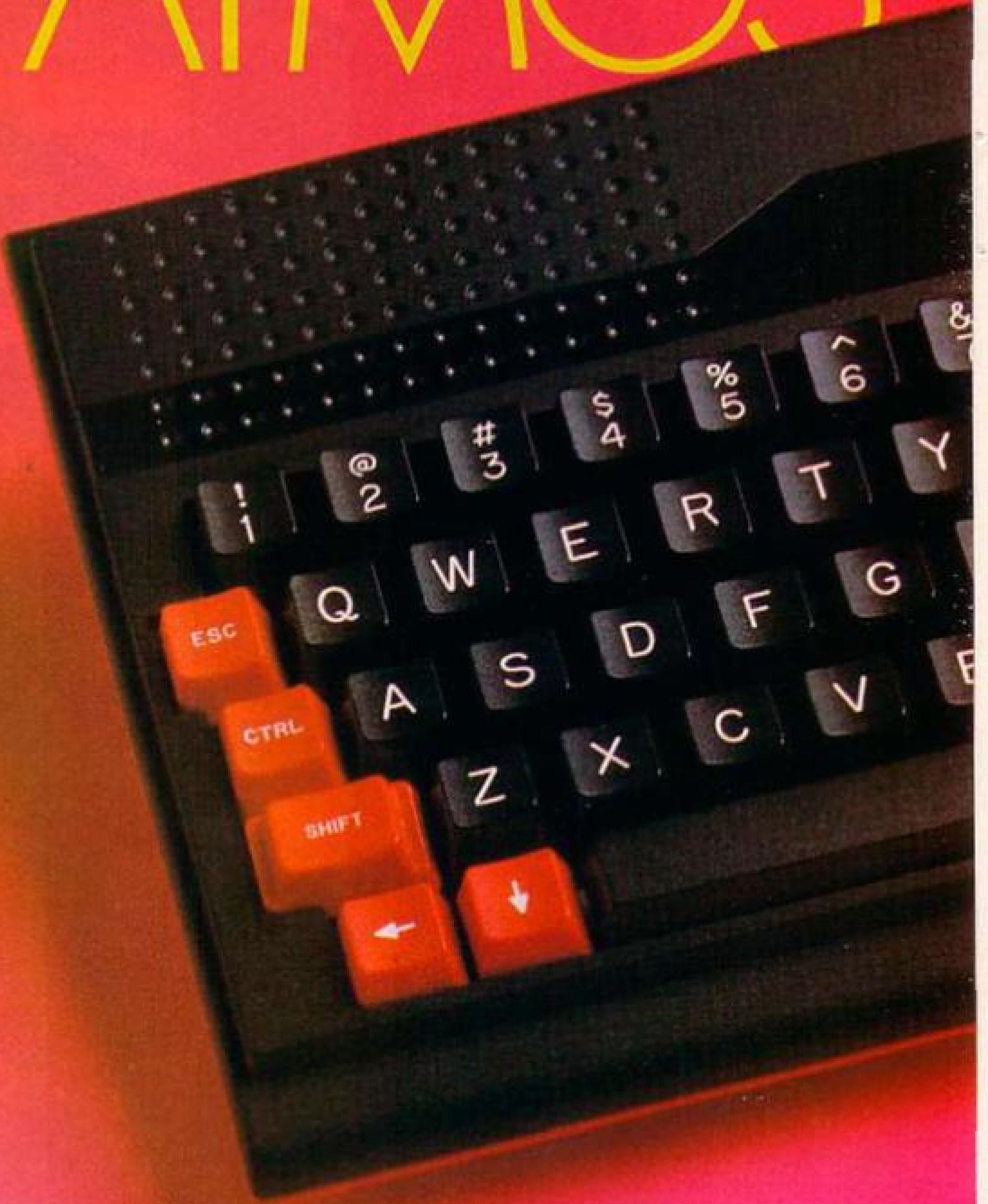
REVIEW

ORIC ATMOS



Its looks may have changed but the soul of the machine remains the same. David Scobie uncovers the Oric lurking under the Atmos' keys.

ORIC-1 IS officially dead and has been replaced by the Oric Atmos. Unlike all the advance blowing of trumpets that heralded the original Oric, Atmos has crept up on us and was not launched until it was actually in production. The official launch was at an exhibition of predominantly business computers where it seemed a little out of place.

The Oric-1 was aimed at the cheap home computer end of the market. A cynical definition of the Oric-1 was "prototype of the Oric-2". The faults were compounded by the non-appearance of many promised additions and peripherals; a disc drive, a communications Modem with a teletext decoder, a ROM cartridge with "super extended Basic as powerful as the BBC's."

It has to be admitted that even in the final version there were some bugs in the ROM-based operating system, but on the whole these were chiefly academic faults as the computer could be used successfully.

The Atmos is exactly the same shape and size as the Oric-1. Internally, the pcb is identical to its predecessor and is still marked "Oric-1". Instead of the rather insipid pale grey appearance the new computer now sports a dashing black and red livery. The little calculator keys of the former machine have been replaced with full typewriter-style keys which are very touch-sensitive and offer full touch-typing facilities. On test, the keyboard was found to be very good with only one minor criticism; the cursor-control keys are very near the shift keys.

The only other difference between the Oric-1 and the Atmos is the new version of the ROM operating system which has, according to Oric, not only ironed out the Oric bugs but also some others inherent in the Microsoft software. A number of additional commands have been added; especially to the cassette routines so that programs can now be verified after they have been saved. Arrays can now be stored and recalled without recourse to machine code.

As for cassette handling, the computer still seems to be over-particular as to the correct volume level set on the recorder playback. I have been using a cassette player which works very successfully with other computers but found it necessary to make several attempts at loading on the Atmos before. I found the exact level. This level seemed to vary from tape to tape so that it often took several attempts to load each program.

Built in to the loading routine is an error-spotting facility which, after the program has loaded, will come up with the message "errors found" — if any were. When a long program is loaded it is very frustrating to get this message after a long wait. There should have been a method of aborting the loading first time, includes a machine-code routine to overcome this. This routine ignores errors in the header and leading part of the tape which are not relevant to the content of the program.

The Basic is adequate and most of the commands that you would expect to find are there. I was surprised to note that there has been no attempt to improve the abysmal line editing facility. In this respect many other computers also claiming to use extended Microsoft Basic are much better — for example the Dragon and the Tandy Colour Computer.

Additional commands include the logic operators And, Or and Not. CLoad"program name",V allows the verification of a program just saved, and CLoad"program name",J allows another program to be joined to one already in memory. It is important that the second program in this case should have

different line numbers so that there is no confusion between the programs.

Remote switching of the cassette is provided through the seven-pin DIN socket, though it is not made use of as a three-pin DIN-to-DIN lead is supplied. To take advantage of this facility it is possible to use the same cassette lead made for the Acorn/BBC Micro and available through most computer shops; many suppliers advertise in this journal.

As for the use of colour; serial attributes, to change colour or style of characters on the screen, take some getting used to, but they do have the advantage of taking up less memory space. They involve remembering a number of control codes and escape codes if you want to take full advantage of them. They are also compatible with teletext, if you were to get a teletext Modem to receive, say, Prestel.

One considerable improvement over the old Oric is the operating manual. It is important that a new user gets the best possible guide on how to put the machine to work. The Oric-1 manual was, frankly, terrible. All has now been put right. A 300-page book has been commissioned by Oric from outside authors, led by Ian Adamson and published by Pan Books for distribution by Oric.

It includes a step-by-step tutorial on getting the Oric working, an introduction to Basic with a section that has detailed descriptions of all the Basic keywords and appropriate short programs to illustrate how they work; sections on cassette handling, sound commands, graphics and very useful introduction to machinecode.

The machine-code section lists the error-ignoring routine included on the "Welcome" tape. There are appendices listing all that you would ever want to know about the internal workings of the operating system, and many other details. It is a pity that there are not a few longer programs but this does not detract from the value of the book. Oric must now go near the top of the league for documentation.

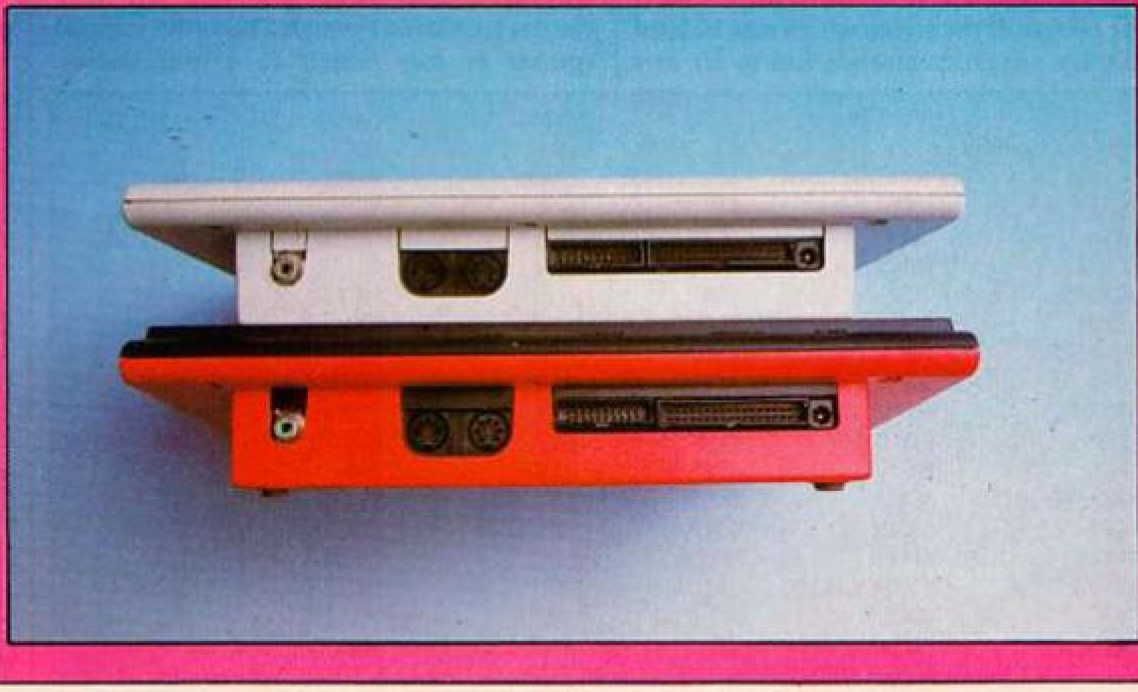
Also provided is a cassette which has a graphics program showing how good the display facilities can be. Included is an animated cartoon of a flying duck which is very impressive, especially as it is written in Basic. The program may be broken into and listed to show how a particular effect is achieved.

The specification for the Atmos include a 6502A processor running at 1MHz, 48K RAM, 16K ROM containing the Basic and the operating system. The keyboard has 57 "real typewriter" keys, including a programmable "function" key for which I can find no reference in the literature or any indication of how it is used; and a concealed reset button for a warm start, i.e., one that does not lose any program or data.

One of its main selling points is that it offers a minimum of 37K of free memory, a lot more than many other computers claiming to have bigger RAMs. This may be increased in the Atmos by grabbing some of the memory reserved for high-resolution graphics. The screen format offers eight foreground and the same eight background colours for a text screen of 40 columns of 28 lines and a character set very similar to teletext — and BBC Mode 7 — with standard ASCII upper and lower-case characters, double-height and flashing characters and up to 80 user-definable characters.

It is a pity that there is not a text screen with even more characters; the new keyboard, disc interface and monitor output provided suggest that the system would be very good for word processing. But this would really need a 60- or 80-column screen format to be useful.

(continued on next page)



Spot the difference. Old white Oric, new red Atmos.

(continued from previous page)

High-resolution graphics offer 240 by 200 pixels in eight colours and there are line, circle and point facilities. Areas of the screen may be filled with a chosen colour, and the Fill command allows the mixing of colours to produce many more than the nominal eight.

The graphics screen has three lines for text at the bottom of the screen which may be used to display system commands and to act as a window on the program. Direct commands may be entered without having to switch to a text screen when their effect may be seen instantly. Text can be easily added to high-resolution graphics so that labels can be added to a chart, for example.

Three channels of sound over eight octaves with additional white noise and envelope control are played through a powerful internal speaker or may output to a hi-fi system. Sounds of musical instruments may be synthesised. On our review model, the sound was much quieter than on the Oric-1 but that might have been a peculiarity of that particular machine and, in any case, it was loud enough.

There is an expansion port for the addition of peripheral equipment, such as disc drives or analogue to digital converters; cartridge ROMs can also be used here. The standard Centronics printer port allows the use of a wide range of different printers, from simple thermal types to word-processor daisywheels as well as the Oric printer.

A modulated TV output as well as an RGB output for a colour monitor is provided and, of course, there is the cassette port. There is no joystick port, though plug-in modules are available from other manufacturers.

The Oric printer/plotter using four coloured ball-point pens as been restyled to match the Atmos colour scheme as has the long-promised 3in. disc drive with 160Kbytes per side and a transfer rate of 250Kbits/s.

In conclusion I think that Oric has got it right this time; the Atmos is what the Oric-1 should have been and, at £170 it is very good value when you compare the facilities with those available on other low-cost computers. Unfortunately, we cannot leave it at that. There is the problem of software availablility. Other computers, with the massive support that they have acquired, may be preferable purely because of the quantity and quality of their software support.

Perhaps the qualities of the new Oric will inspire confidence in some of the software houses and the Atmos will then take off — into the Atmosphere? A low-cost Atmos 16K machine is also promised, but I think that the extra memory of the 48K machine is well worth having.

Those who already have an Oric-1 need not despair or throw it in the bin. Oric is looking seriously at the possibility of providing an upgrade kit to turn an Oric-1 into an Atmos. This could cost about £50. 160,000 Oric-1s were sold so this could be a major opration. I would advise those who do have an Oric-1 to shower Oric International with letters demanding that such an upgrade be made available.

It would be worth it as there is a fantastic difference between the feel of the two machines. The difference is that Atmos is a real computer, while Oric felt like a toy.

Basic Keywords.

			LET	LIST	LLIST
			LN	LOG	LORES
			LPRINT	MID$	MUSIC
ABS	AND	ASC	NEW	NOT	ON
ATN	CALL	CHAR	OR	PAPER	PATTERN
CHR$	CIRCLE	CLEAR	PEEK	PI	PING
CLOAD	CLS	CONT	PLAY	PLOT	POINT
COS	CSAVE	CURMOV	POKE	POP	POS
CURSET	DATA	DEEK	PRINT	PULL	RECALL
DEF	DIM	DOKE	READ	RELEASE	REM
DRAW	EDIT	END	REPEAT	RESTORE	RETURN
EXP	EXPLODE	FALSE	RIGHTS$	RND	RUN
FILL	FN	GET	SCRN	SGN	SHOOT
FOR...TO...(STEP)	NEXT	FRE	SIN	SOUND	SPC
GET	GOSUB	GOTO	SQR	STOP	STORE
GRAB	HEX$	HIMEM	STR$	TAB	TAN
HIRES	IF...THEN...(ELSE)		TEXT	TROFF	TRON
INK	INPUT	INT	TRUE	USR	VAL
KEY$	LEFT$	LEN	WAIT	ZAP	

CONCLUSIONS

- The Atmos is a considerable improvement on the Oric-1.
- Real keys and an improved Basic that really works make a tremendous difference.
- At £170 it offers fair value for money. But its price takes it out of direct competition with the Spectrum and into a battle with the Dragon and Atari 600XL.
- If it gets the software support it could take its place alongside the Spectrum and the Dragon — its capabilities and specification are equal to both and in some respects superior.

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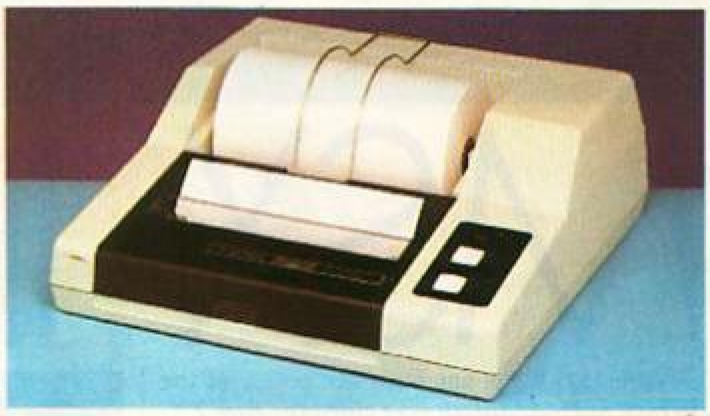

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Sony and Yamaha lead the MSX micro brigade charge from Japan. Meirion Jones finds out why.

MSX INVADERS

DIVIDE AND RULE has been the policy of the British micro industry ever since the first ZX-80 flipped off the end of the production line. Oric programs will not run on Acorns and Acorn programs will not run on Dragons. Sinclair is now producing three different home computers — ZX-81, Spectrum and QL — which are not even compatible with each other.

This nightmare for the British computer consumer does not suit the tidy Japanese electronics giants either. They have already flooded the world with hi-fi, cameras, videos, cars and motor bikes. Think of Sony, Canon, JVC, Mitsubishi and Yamaha. They are just some of the dozen top Japanese companies which now plan to export millions of home micros a year.

The clever bit about it is that they will all be able to run the same MSX software because they all speak MSX Basic and have the same chip set at the heart of the machine however different their computers may look on the surface. You can pull an MSX games cartridge out of your friend's Sony and plug it straight into your Yamaha.

Although the MSX specificiation seems adequate rather than excitingly new the combination of the excellent MSX Basic and the number o peripherals being offered with them make the new Japanese machines very interesting.

You can buy a plug-in synthesiser and keyboard for the Yamaha, the JVC and top-of-the-line Sanyo will load in the process video pictures, and the National has the option of a £200 full-colour A4 printer.

In Japan MSX micro prices range from about £140 to well over £200. Whatever the price, the MSX standard specifies that the computer must have the equivalent of a Z-80A central processor — Sinclair's old favourite — TMS-9918A video chip and AY-3-8910 sound

chip. This gives up to 256 by 192 graphics resolution, 32 by 24 text resoltuion, 16 colours, 32 sprites and eight-octave three-voice sound.

Microsoft, the American software house which wrote MSX Basic and originally announced the MSX hardware standard last summer has already produced a design for putting all the necessary MSX chips onto a single slice of silicon. This could eventually reduce the price of an MSX computer to around £30 but it will be at least a year before they even start production of the monster chips.

Sanyo was the fastest off the mark with the MSX. Late last year — just three months after the standard was announced — Sanyo had a whole range of new computers. The Sanyo MPC-5 which looks a little like the Texas TI-99/4 has a real keyboard, 32K RAM, crude music synthesiser, and two cartridge slots for around £130 in Japan.

The sleek black MPC-10 has a light-pen already attached with which you can select options on screen from a menu. The 10 costs £150 over there but top of the range is the £190 MPC-X which has a additional non-standard MSX graphics mode which allows up to 500 by 200 resolution — approaching the BBC Micro — and a video grabber which would allow you for instance to put captions on your favourite video clips.

The JVC HC-5 is another video grabber, although for £150 it offers only 16K RAM and a second-rate keyboard.

Another machine spoilt by a cheap keyboard is surprisingly the Sony Hit-Bit. Sony's industrial designers have acquired a well-deserved reputation for combining economical engineering and attractive appearance in their products. Despite the bright-red case, the Hit-Bit HB-55 with its 16K — 12.5K free — is a disappointment.

One interesting idea that Sony has come up with, though, is a data retrieval cartridge. You just plug it in like a games cartridge and then use it as a short-term diary or address book. The 4K of CMOS-style memory is battery-backed so you can just pull out the cartridge without losing the data.

Many of the MSX machines have two cartridge ports so you can plug extra RAM into one and applications software — such as a word processor into the other. According to the MSX standard the machines must have a 32K ROM and at least 8K RAM. So far all the MSX micros have had at least 16K RAM and many have 64K.

In theory, MSX machines could address as much as 1 Mbyte of RAM although the biggest so far is the Hitachi MBH-1 which with a plug-in RAM cartridge tops 96K RAM. The MBH-1 is a neatly designed portable which costs around £150 in Japan and is being promoted very heavily as a youth status symbol.

Although the Canon V-10 is in the same price range, smart design makes it look like a business micro. It has the five function keys which are part of the MSX specification but

like many of the other micros it uses the shift key to double up to 10. At the other extreme the Fujitsu FM-X is the tattiest looking — the model I tried even had a live keyboard.

Spectravideo jumped the gun with the SV-318 and 328. Although Spectravideo signed the MSX agreement and claims in some advertisements to be MSX compatible, the cartridge slot will not accept MSX cartridges and the Basic is non-standard.

Even Mitsubishi, the giant ship and car builder is getting in on the MSX act. Already famous for the robots in its factories it is no surprise that the first perhiperal for the Mitsubishi ML-8000 32K computer is a robot arm with the promise of more android add-ons to come.

With the same specification at the heart of all the machines the Japanese companies go to great lengths to distinguish them cosmetically. The position of the cursor keys is specified, so each machine tries to look different by using cursor pads, diamond-shaped keys or even built-in joysticks. All MSX machines have at least one Atari-style joystick port.

The Toshiba Pasopia IQ HX-10 — which surely wins the prize for the longest name — comes in two versions, the D with 64K for about £160 and the S with 16K for £140, colour codes its keys — red for stop, green for graphics and grey for functions.

The 64K National CF-2000 has only 28.5K free and the 16K version has about 12K free. Its strongest selling point is likely to be the sub-£200 four-colour A4 CF-2311 printer plotter which goes with it.

Perhaps the most exciting of all the MSX micros is the Yamaha YIS-503 with its plug-in keyboard and synthesiser. Full details of the 503 and its big brother the XC-5 which can control a whole stage full of synthesisers and will go on sale in Britain in October are given in this month's News pages.

Although the MSX machines are already coming off the lines at 50,000 a month the most impressive part of the operation is the speed with which all the arcade favourites are being converted to MSX. Word processors spreadsheets and utilities are also appearing at great speed and because the big Japanese consumer goods are making some of their other products MSX compatible new applications are appearing.

The new Pioneer will plug straight into a hi-fi rack and software will soon be avilable to control your whole entertainment system. The video grabbers have been already mentioned and once the MSX system is available on a single chip it will be built into all sorts of household goods — although an MSX fridge might have limited applications.

Although apart from Spectravideo all the MSX companies have been Japanese so far there is no reason why that should continue. Philips is on the verge of signing a deal to produce machines in Europe and two big British electronics manufacturers are also interested. One high street store is considering a badge-engineered version for its own shops.

With so many MSX machines around peripherals should also become cheaper — disc drives and A4 printers may fall to around £120. ■

ZX SPECTR

Jim Taylor ploughs through some of the best and worst of Spectrum software looking for originality.

STRAIGHTFORWARD VERSIONS of arcade games on the Spectrum often seem to lack something. This missing ingredient is usually sound. Since the Spectrum's capabilities in this area are so limited you hardly ever get those deafening screeches and crashes.

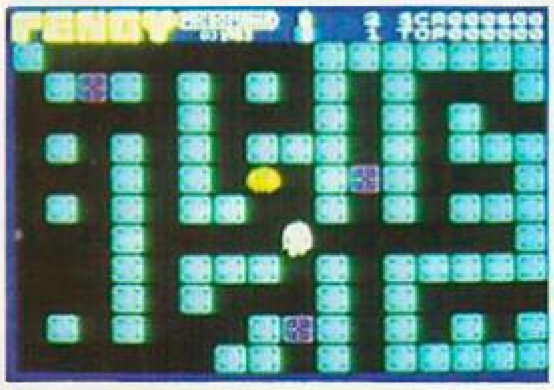
For this reason the most successful Spectrum software usually has a more offbeat theme, giving you a game where sheer noise is not too important.

One recent development that programmers are now using is 3D graphics. Quicksilva's Ant Attack led the way, and now many are following. A recent program which makes the most of 3D is Micromega's 3D Deathchase.

The scenario casts you as one of the Riders of the Big Bikes in a future devastated by war. Everywhere are evil enemy riders as well as helicopters and tanks. You must destroy these lawless renegades in a high-speed chase.

The game gives a tremendous 3D effect. Only your hands and front wheel are visible; the rest of the screen is taken up with the looming trees through which the enemy riders weave.

In sector 1 it is quite easy, even at speed, to avoid the trees. Sector 2, however, is much more difficult and I have yet to meet anyone who has penetrated sector 8.



Not all 3D games are quite so enthralling. Add on's 3D Star Wars casts you as Luke Clearthinker, whoever he is. The screen displays a view of space through which hurtle the enemy ships, controlled by Darth Vader.

You have crosshair sights to blast the enemy and a number of scanners and gauges to help you. The graphics are quite pleasant, but do not really give the total 3D effect.

Ed-on from Add-on is a version of the game where your car has to eat the dots in a maze without crashing into an opposing car controlled by the computer. The graphics are average and the appeal is limited to those who like games where your car has to eat all the dots in a maze without crashing into another car.

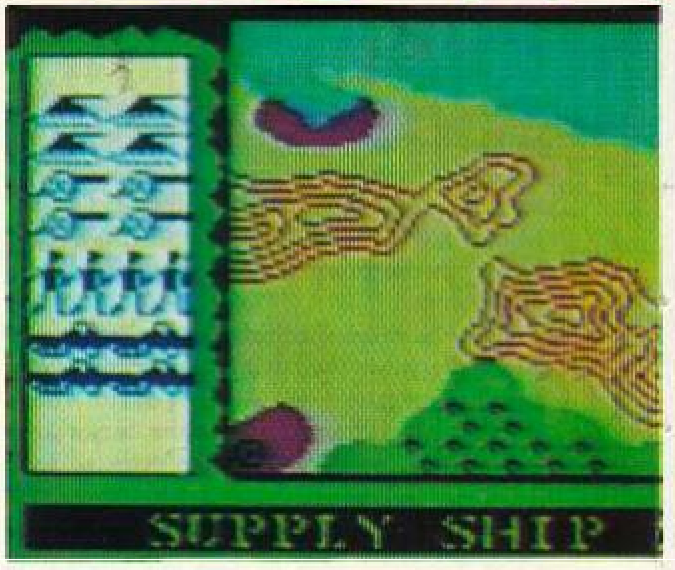
Centipede on a grid

Grid Bug, from the same company, is Centipede on a grid. It is noteworthy chiefly for the strange chirruping noises.

A better version is Visions' Rapedes, subtitled for Centipedes' Revenge. The programs here are very colourful, with luscious green mushrooms and sharply defined crabs and snails. Unfortunatley, there is not repeat-fire.

Automata's Pi-Eyed is althogether more original and much more repulsive. It is a so-called "comedy arcade game", but you would have to be drain to find it very funny. Stardom, it seems, has been too much for the Pi-man. He's on his uppers down in Skid Row, drinking.

You have to guide his drunken steps through the traffic and into such adjacent hostelries as "The Gay Dog", which he cannot leave until he has consumed all the



beer on the bar. You have to avoid the pool players and crisp packets and get in quick.

The "comedy" comes when, for example, you wander into the local indian restaurant. Here you are told that you will be served "bowel explosives" so that you can "regurgitate your beer on the pavement". Fortunately, they do not serve Pi-men.

Penguins have lately become micro starts, as can be seen in Micromania's Pengy. This is the grid game where the Penguin has to push ice-blocks onto the sno-bees before they get him. Pengy himself is an amorphous white blob, bearing scant resemblance to the biscuit we all know and love. The sno-bees are not very weel-defined either.

But, Donner and Blitzen! Is this a German version of the same game I see before me? A game in which "Punkte so durch das treibeis, dass sie den sno-bees ins wasser gewarfen".

Indeed Pingo is the same game, but Profisoft version is rather better, if only because the graphics are clearer and the

Company	Program	Price
Add On, Units 2, 3, 4, Shire Hill Industrial Estate, Saffron Walden, Essex.	Ed-On 3D Star Wars Gridbug	
Artic, Main Street, Brandsburton, Driffield, Yorkshire.	Earth Defence	£4.95
Automata, 27 Highland Road, Portsmouth Hants.	Pi-Eyed	£6.00
Cases Computer Simulations, 14 Lanton Way, London, SE3.	Battle 1917	£6.00
DK'tronics, Shire Hill Industrial Estate, Saffron Waldon, Essex.	Galactians	£5.95
Imagine, 5 Sir Thomas Street, Liverpool.	Stonkers The Alchemist	£5.50 £5.50
Micro-gen, 24 Agar Crescent, Bracknell, Berkshire.	Naanas	£5.95
Micromania 14 Lower Hill Road, Epsom, Surrey.	Pengy	
Micromega, 230-236 Lavender Hill, London SW11.	3D Deathchase	£6.95
Profisoft, Sutthauser Strasse, 50-52, 4500 Osrabruck, W. Germany.	Pingo Alien Curse	
Virgin Games, 61-63 Portobello Road, London, W11.	Rider	£5.95
Visions, 1 Fellgate Mews, Studlands Street, London.	Rapedes	£5.95

UM SOFTWARE

colours brighter.

Alien Curse does not refer to foreign software, but is another game from Profisoft; something to do with "Bildschirms herunterfallenden Bomben . . .". Essentially, it is Galaxians.

Imagine's The Alchemist is an intriguing new arcade adventure of great graphics sophistication. You can tell it is a classy game because it starts off with a Bach fugue. The idea is that you, the alchemist, do battle with the evil warlock in his castle. You must find four sections of the magic scroll and a "Spell of Destruction".

The Alchemist is a suitably old-fashioned looking fellow with a pointed hat and a beard, who trundles around as if on wheels. To change to the castles various levels he can transform himself into an eagle; a very entertaining piece of graphics.

Various objects can be used to help the Alchemist on his quest, and he must regularly find food to keep up his stamina levels. This is not an easy game to get the hang of, but repays investigation.

Left: Pengy from Micromania. Above left: Stonkers from Imagine. Above right: 3D Deathchase from Micromega. Below: Pi-Eyed from Automata.

Talking of games difficult to get the hang of brings us to Stonkers, also from Imagine. The adverts say that "Stonkers will drive you Bonkers", and I would not want to argue with that. The instructions are long and unclear, and you will probably pick up the idea quicker by just playing.

Essentially, this is a strategy game with graphics. You move a cursor over the large map displayed and the area is then magnified 64 times. You have to move your forces to positions of strategic importance and ensure a constant flow of supply ships to your port.

I think a good idea seems to be to go for the bridge connecting two land masses. Stonkers' graphics are disappointingly unclear and the game itself is difficult to play, but strategy fans my find it worth the effort.

They will also be interested in Battle 1917, from Cases Computer Simulations, which won last year's Cambridge Award — whatever that is. It's another war strategy game in which, as in chess, you protect your own king while trying to capture your opponent's.

You have artillery, infantry, cavalry and tanks which can be moved around the board displaying the landscape. There are forests, lakes and areas of barbed wire to impede your progress or provide cover. Battle 1917 is rather more simple in conception than Stonkers but, perhaps because of that, is more satisfying to play.

Mikrogen's Naanas requires no such intellectual effort. The idea is quite drole; you must catch the falling bananas and avoid the coconuts being hurled down by a swinging monkey. Your man rushes around with a basket at the bottom of the screen. If he misses any bananas they will be slipped on.

Unfortunately, the graphics are not quite sharp enough for you to notice the skins easily. Many a tumble is taken. The game, though, is good fun and bananas certainly makes a change from aliens.

But there are oodles of aliens in DK'tronics Galactians which, as the name suggests, is a version of a well-known arcade game. The graphics are very good and the game is pretty fast — perhaps too fast, for the aliens always seem to get you.

Virgin's Rider is another game with motorcycles and 3D, but this time in two parts. first you have to parachute onto a motorbike in enemy territory. This is not too difficult but is nicely done; the parachutists wriggles convincingly in his harness as he descends.

Once on a motorbike you have to investigate an enemy road full of mines. Here the 3D is rather annoying since the landscape moves instead of the bike, giving you a feeling of going nowhere fast. The graphics are not very special either, with a rudimentary landscape and buildings.

Earth defence, from Artic, is a version of Missile Command, the game in which you have to lay a defensive blanket of missile fire against the descending alien guns. For a game in only 16K, this is quite an impressive version with good bright colours and reasonable sound effects.

Overall, the shoot-'em ups are losing out in the Spectrum software market. Consumers are growing tired of re-cycled arcade fare. What they want is originality with superb graphics, and still too few companies are providing these. ■

Your Computer and Melbourne House take you beyond the screen into the realms where silicon adventures stop and the real quest begins. Enter our competition and if your answers are good enough we'll put you to the test in a castle full of treasure.

YOUR COMPUTER

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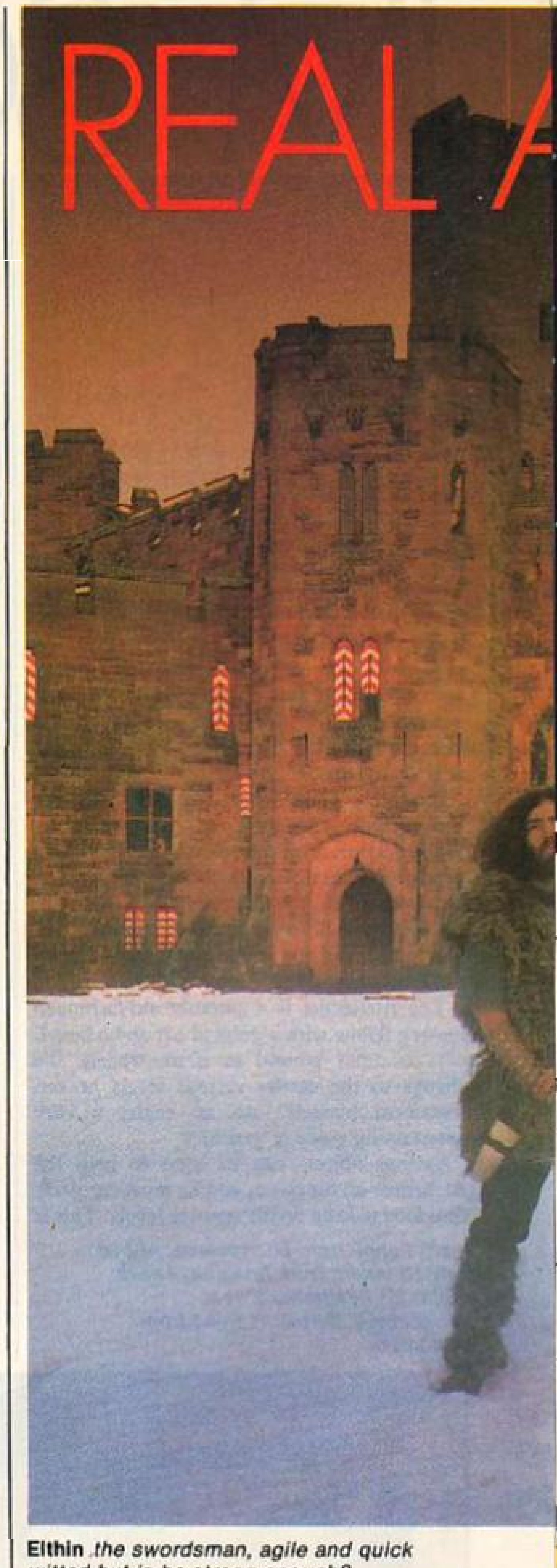


Elthin *the swordsman, agile and quick witted but is he strong enough?*

LONG, LONG AGO when the world was still flat and dinosaur computers still ruled the earth — 10 years ago to be precise — two men far away across the sea invented a came called Dungeons and Dragons or D&D.

These two, with the unlikely names of Arnson and Gygax, produced a framework for a fantasy world in which bank clerks, computer programmers and hospital porters could get together at weekends and pretend to be wizards or rulers of the universe.

Two years passed, and the amount of paper needed to record the details of a thousand fantasy universes started to fill whole garages. As an emergency measure some of the programmers started to transfer the details of their weekend Dungeon and Dragon existences on to computer.

Later that year two students called Crowther and Woods hijacked some computer time at Standford University California, and wrote the first ever computer based D&D-style game.

It was called Adventure and soon became wildly popular, the only trouble was it took up so much memory — around 300K — that you needed a mainframe to play it.

Meanwhile, in another garage, two lads with the equally unlikely names of Jobs and Wozniak were busy inventing the Apple — the first of the wave of home computers which one day would bring Adventure to the masses.

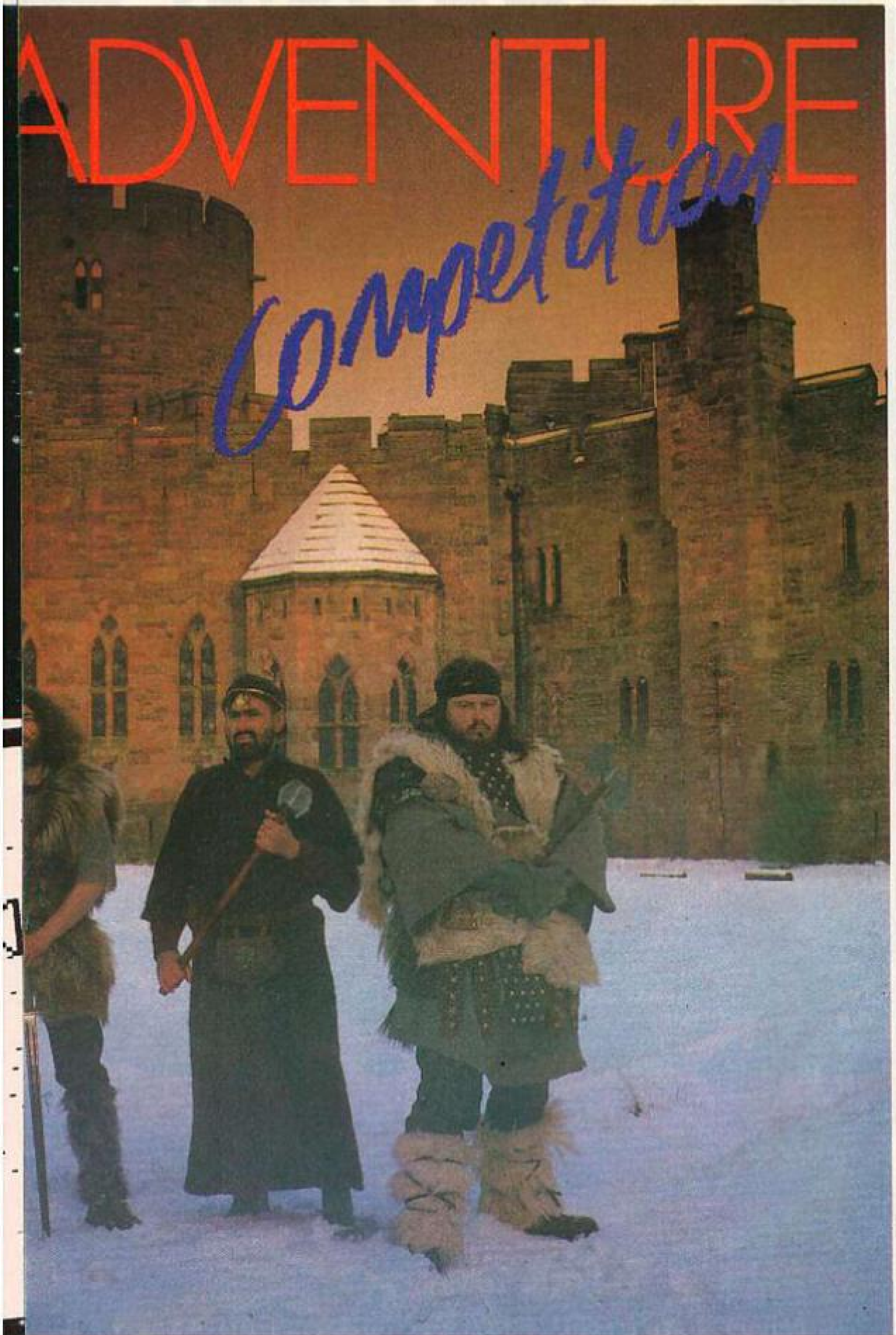
Now Melbourne House has produced the first ever version of that original computer Adventure for the Spectrum. Classic Adventure, as Melbourne House is calling it, fits tidily into a 48K Spectrum. A Commodore 64 version is also under development.

It does not have the fancy graphics or elaborate plots of some of the latest adventures but if you want to find out where it all started Classic Adventure is a must. To mark the launch of Classic Adventure on the Spectrum and the tenth anniversary of the Dungeons and Dragons fantasy idea, *Your Computer* and Melbourne House are getting together to offer eight of you an all expenses paid chance to go on a real-life adventure and find the treasure we are going to hide in Peckforton Castle, Cheshire.

Peckforton Castle is run by Treasure Trap, a secret society of dedicated games players who are not satisfied with playing D&D at a table or adventure on screen but demand the real

RULES

- The eight finalists will be those who answer the three questions correctly and, in the view of the editor, offer the best reasons, in 12 words or fewer for enjoying adventures.
- The name of the winner will be printed in the May issue of *Your Computer.*
- All entries must arrive at the *Your Computer* offices by the last working day in March 1984.
- Each person may enter the competition only once.
- Entries to the competition cannot be acknowledged.
- No employees of Business Press International or their relatives may enter the competition.
- The decision of the editor is final.
- No correspondence on the result of the competition will be entered into. Business Press International assumes no responsibility or liability for any complaints arising from this competition.



Chrom *the magician, clever and powerful but can you trust him?*

Jabbarl *the axeman, strong and resilient but is he fast enough?*

thing — a chance to play out their fantasies.

The adventurers are kitted out in sackcloth and then have to have make their way through the darkened chambers of the castle deciding which doors to enter and dealing with monsters, magicians and alchemists along the way.

Our eight finalists will be put through this experience — with the added ingredient of hidden treasure — and then we will turn them into monsters to terrify the next party of adventurers to pass through the castle.

All you have to do to win a place in the final at Peckforton Castle is read the description of the adventure problem on the right and imagine what you woud do.

What would you drop, what would you pick up, who would you choose as your companion on the journey? Then write your answers on the coupon together with a description in 12 words or less of why you like adventures.

There will be 10 runners-up prizes of Classic Adventure if you have a Spectrum or Commodore 64 or another exciting Melbourne House adventure if you have a different machine.

You have been travelling since dawn and have just walked across the drawbridge into the courtyard of a mysterious castle. You are carrying a leather satchel full of dry bread, a flask of water and a torch. Laying in the snow in front of you are a dagger, a golden staff and a bunch of keys. You must put down one of the items you are carrying and pick up one of the objects in the snow. You make your choice and step forward. In front of you are Elthin the swordsman, Chron the magician, and Jabbarl the axeman. Behind them is a door in a tower through which you must pass. Choose one of the three characters to help you in your mission.

Mark you choices with a cross.

Which item would you drop?
- Bread ☐
- Water ☐
- Torch ☐

Which object would you pick up?
- Dagger ☐
- Staff ☐
- Keys ☐

Now write your reasons for enjoying adventures in 12 words or less and send this coupon to *Your Computer*, Quadrant House, The Quadrant, Sutton, Surrey, SM2 5AS.

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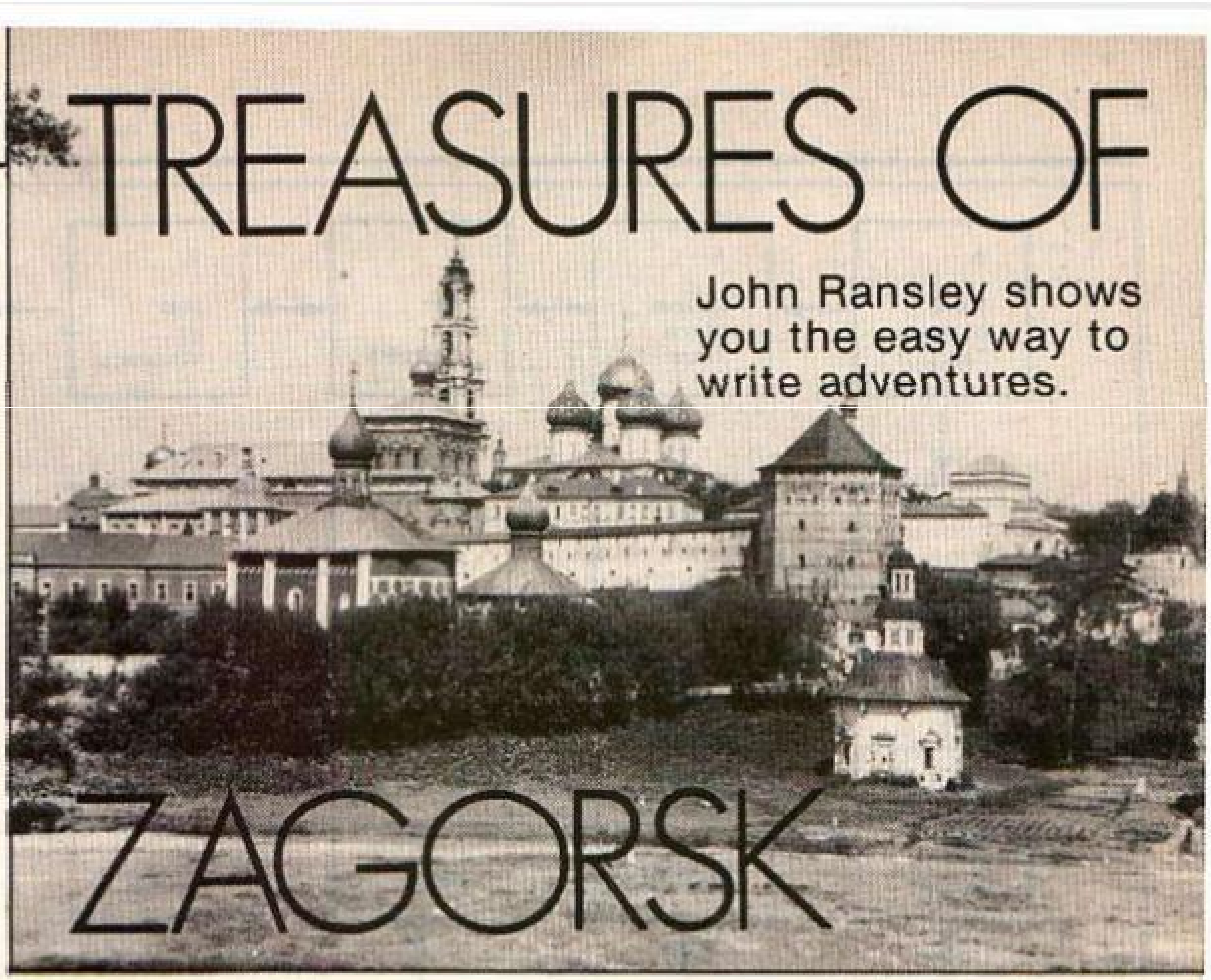

THE DATE IS June 23, 1941 and many parts of the city of Moscow are wreathed still in a shroud of smoke and dust.

Three collaborators meet again in the conference room of a bombproof complex deep beneath the featureless grey apron of Red Square.

Only one of them is Russian. He is General Kerch, a long-serving member of *Stavka,* the Soviet High Command, who has more recently worked as a senior aide to Marshal Timoshenko. The second man is Hemmo Tolman, a Dutch art historian and dealer who has been in Moscow several months already, advising the autorities on which of the country's state treasures merit priority protection.

The last of the trio is General Sir Ralph Beaumont, a security officer invited to Russia together with a team of British ARPs to advise on use of the city's newly-built underground railway stations as public bomb shelters.

By the time their discussions, arguments and concessions have run their full course some three hours later, each man has drawn up an identical list of 29 treasures from St Basil's Cathedral, the Imperial Palace, state apartments and other Government offices throughout the captial.

These are now stored elsewhere in the complex and safe from immediate danger — but the threat of a successful invasion by German panzer divisions has compelled Kerch to find a safer home for them.

There is little dispute about the choice of this at least. The guardianship of Moscow's treasures, including the fabulous and priceless St Petersburg Ikon, is to be entrusted to the multiple crypts of Zagorsk Monastery.

Kerch, Tolman and Sir Ralph travel with the convoy of lorries and armed half-tracks, and upon their arrival at Zagorsk they painstakingly supervise the hiding of the treasures. The most important of all, the ikon, is allocated a secret chamber to itself.

Satisfied with their endeavours, the three men embark on the tiring journey back to Moscow. But when only a little way out of Zagorsk, the screaming engines of a dive bomber pierce the night air and it finds its target on the road below. The convoy lies like a crippled, burning snake within minutes. Why it was that the plane bore no markings may never be known.

As a descendent of Sir Ralph Beaumont, you have heard this story told many times — and it has inevitably intrigured you. Now, after years of behind-the-scenes diplomacy, the Russian authorities have given you permission to make an attempt at finding the ikon — the only artefact they have not managed to retrieve from the crypt of the monastery.

As you descend the slab stone steps into the crypt for the first time, you are only too aware that your life could end, perhaps horrifically, within minutes. But the ikon is there to be found, and with its discovery goes a personal reward of two million US dollars.

Just one thing. You are not alone in the crypt. Somewhere in its labyrinthine soul awaits the man who fixed in his gun and bomb sights the convoy in which your antecedent was killed more than 40 years ago. Worse still, the crypt has a supernatural power of its own.

●If you have in the past been put off by the apparent complexity of programming this kind of micro entertainment, let us start now on blowing away all misconceptions of that kind. After all, any adventure program is nought but a series of If . . . Then . . . Else statements and a smattering of Gotos and Gosubs — sorry, you structured programmers!

Sure, you can dress them up with all sorts of bells and whistles, but once you have acquired the knack of setting up the program skeleton, you can use that skeleton time and time again to create what seem to be totally different scenarios and situations.

This month, we will set up the map, fill it with locations, and give some thought to the objects and obstacles which will start to make it interesting. We can also test a sample of the program lines involved.

Next month's final article will add the finishing touches and present a complete listing fat with helpful Rems by way of recapping all you have learnt.

At first, it may be a little difficult to grasp that all the geography of a pirate island, ghostly castle or lunar landscape can be contained and interpreted by a simple grid. But it is easy to do, as our sample adventure set in the crypts of Zagorsk Monastery will show — see *Your Computer,* September and October, 1983.

For this, we will use a grid comprising 36 locations. Each box must be numbered sequentially, from left to right, row by row. When drafting your locations, you will want to give some thought also to the pattern of movement you may allow between them.

As you can see, the avenues between the boxes are supplemented in some instances by one-way or two-way arrows. These indicate the legal moves between locations.

Locations 11 and 32 are single-location traps or dead ends — you can enter them but not exit.

Similarly, the rather more elaborate quad of iniquity ensures an endless trek in one direction.

The program should allow you to move swiftly from location to location, announce your current position, and warn if you attempt an illegal move. This procedure can be thought of almost as a self contained module, and the sample listing which should Run on any micro using Basic, will let you test the logic for yourself.

In line 120, it fixes your starting position at location 1 the sample only admits half the grid, to location 17, so location 22 cannot be used which is the chapel of the Tsars. Alter this to any number between 2 and 17 if you would like to start somewhere different.

Control then passes to line 150. If your

```
100 REM SAMPLE ROUTINE
105 PRINT "YOUR LOCATION IS ";
110 REM SET LOCATION
120 P=1
130 GOTO 150
140 P=CP
150 IF P<12 THEN ON P GOTO 460,470,480,490,500,510,520,530,540,550,560
160 IF P<18 THEN ON P-11 GOTO 570,580,590,600,610,620
180 IF P>17 THEN GOTO 320
200 PRINT:PRINT
210 PRINT"YOU MAY MOVE ";
220 IF N>0 THEN PRINT "NORTH/";
230 IF S>0 THEN PRINT "SOUTH/";
240 IF E>0 THEN PRINT "EAST/";
250 IF W>0 THEN PRINT "WEST"
260 PRINT:PRINT "WHICH WAY NOW?":PRINT
270 INPUT D$
280 IF D$="NORTH" AND N>0 THEN CP=P-6:GOTO 140
290 IF D$="SOUTH" AND S>0 THEN CP=P+6:GOTO 140
300 IF D$="EAST" AND E>0 THEN CP=P+1:GOTO 140
310 IF D$="WEST" AND W>0 THEN CP=P-1:GOTO 140
320 PRINT:PRINT
330 PRINT "YOU CAN'T GO ";D$:GOTO 210
455 N=0:S=6:E=1:W=0:GOTO 200
460 PRINT "CHAPEL OF TEARS"
465 N=0:S=7:E=2:W=0:GOTO 200
470 PRINT "HALL OF WHISPERS"
475 N=0:S=0:E=3:W=1:GOTO 200
480 PRINT "HALL OF WHISPERS"
485 N=0:S=0:E=4:W=2:GOTO 200
490 PRINT "DRINKING FOUNTAIN"
495 N=0:S=10:E=5:W=0:GOTO 200
500 PRINT "ARMOURY"
505 N=0:S=0:E=0:W=4:GOTO 200
510 PRINT "TOMB OF ST PETRIE"
515 N=0:S=12:E=7:W=0:GOTO 200
520 PRINT "MARBLE HALL"
525 N=1:S=13:E=0:W=6:GOTO 200
530 PRINT "QUAD OF INIQUITY"
535 N=0:S=14:E=0:W=0:GOTO 200
540 PRINT "QUAD OF INIQUITY"
545 N=0:S=0:E=0:W=8:GOTO 200
550 PRINT "ARCHIVES"
555 N=0:S=16:E=11:W=9:GOTO 200
560 PRINT "SEALED CHAMBER"
565 N=0:S=0:E=0:W=0:GOTO 200
570 PRINT "ALTAR OF SORROWS"
575 N=6:S=18:E=0:W=0:GOTO 200
580 PRINT"MINERAL SPRING"
585 N=0:S=19:E=0:W=12:GOTO 200
590 PRINT "QUAD OF INIQUITY"
595 N=0:S=0:E=15:W=0:GOTO 200
600 PRINT "QUAD OF INIQUITY"
605 N=9:S=0:E=0:W=0:GOTO 200
610 PRINT "SCRIBES' ROOM"
615 N=0:S=22:E=17:W=15:GOTO 200
620 PRINT "WALL OF DEVOTIONS"
625 N=0:S=23:E=0:W=16:GOTO 200
```

(continued on next page)

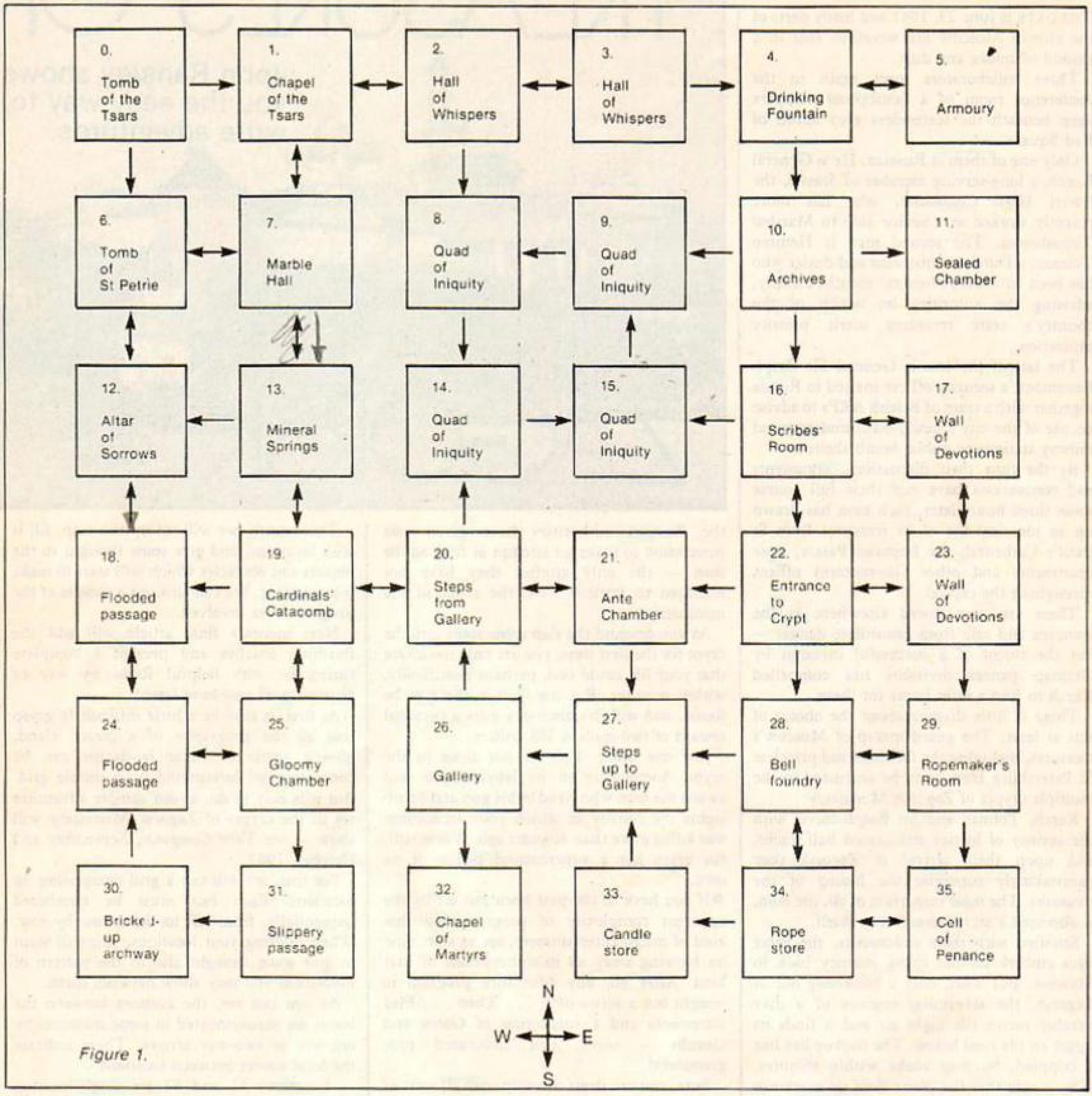

Figure 1.

(continued from previous page)

current position — that is, the number of the box — is less than 12, which takes us up to the sealed chamber, then the On . . . Goto counts that same number of times along the queue of line numbers and passes control to that which matches. For example, location 4 — the drinking fountain — would point to the fourth line number in the queue, which is 490.

If your current position is at a location numbered higher than 11 but less than 18, line 150 is ignored and 160 gets to work on the same selection process. Any figure above 17 triggers a no-go message — but in the full program, of course, we shall introduce additional On . . . Goto lines to generate the response text for locations 18 to 35.

Reverting to your original position, your starting point at location 1 will trigger line 460, printing to screen the information "chapel of Tsars". Almost instantly, line 465 determines the legal and illegal moves from that location.

Compare this line with the grid. From location 1, you cannot move north — so that illegal move, like all others, is awarded a value of 0. The same goes for a move west. But you can move east into the hall of whispers. This is location 2, so E=2. Likewise, S(outh) is awarded a vlaue of 7, as a move in that direction to enter the Marble Hall is also permitted.

It is important to remember that any location into which you cannot move is awarded a value of 0.

Each location has its own screen prompt and complementary movement — and these are all looked after in lines 460 to 625 inclusive. After each move, control passes to line 200 which, working on the values just set for the variables N, S, E and W generates the correct screen information, and line 260 invites your instructions.

You must type out the direction in full and provided such a move is legal line 280, 290, 300 or 310 will set the new variable CP — current position — to reflect your new square — one square to the left or right to represent west or east, six squares up or down for north or south.

If you try to enter an illegal move or mistype then all four lines ignore you and 330 triggers an on-screen reprimand, before looping you back to line 210.

One warning, because this is a truncated version of the proper program; entering "SOUTH" when you are at any location between 12 and 17 will corrupt the Run.

Having tried walking round the crypts a few times to prove to yourself that all this works, you may then like to change some of the location names and legal movements by tinkering with lines 460 to 625. ■

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MILLIPODS

S Cockeram, D Wakelin and P Tomson with a centipede-type game.

MILLIPODS RUNS on unexpanded Vic-20 with joystick, but you will need at least 3K expansion to enter the program. If you have a Vic-20 with greater expansion, then use these Pokes to reconfigure it to 3K for entering the program:

POKE 641,0:POKE 642,4:POKE 643,0;
POKE 644,30:POKE 648,30:SYS 64824

To make your Vic-20 think it is unexpanded for the purpose of running Millipods, type:

POKE 641,0:POKE 642,16:POKE 643,0:
POKE 644,30:POKE 648,30:SYS 64824

The object code occupies nearly all available memory on the unexpanded machine. The game itself loads in two parts — 1. listing 1; 2. object code.

Listing 1 prints up a title, sets up the zero page for use and the kernal for loading the object code file.

First key in listing 1, check it carefully and then save it. Now you must enter the object code. This will require a lot of time and patience. Type in listing 2, this is the loader program. Save it on a different cassette from listing 1, then run it. You will be confronted with a menu:

1. Enter Code.
2. Check Code.
3. Save Code.
4. Load Code.

Pressing 1, you will be asked for a start address, in decimal, of the locations you wish to enter into. To finish and return to the menu. Type an asterisk.

Pressing 2, you must also give the start address and this will allow you to view each location on a separate line.

Once you have finished keying in everything you can save Millipods on a blank cassette. To do this Load Listing 1, insert a blank tape, Type:

SAVE "MILLIPODS"

(continued on page 83)

Level table.

Level	Number of Millipods	Time to Arrive — Spider	Length of Millipods 1	2	3
1	1	46	5	0	0
2	1	32	6	0	0
3	2	78	4	3	0
4	2	46	5	4	0
5	2	32	6	4	0
6	2	19	6	6	0
7	3	78	5	4	3
8	3	46	5	5	4

There are 15 levels in all.

Listing 1.

```
10 POKE 37150,127
20 POKE 37151,127
30 POKE36879,8
40 PRINT:PRINT:PRINT:PRINT"          MILLIPODS":PRINT:PRINT"     BY D.WAKELIN & "
50 PRINT:PRINT:PRINT"       S.COCKERAM"
60 PRINT:PRINT:PRINT:PRINT:PRINT"      IS NOW LOADING"
70 PRINT:PRINT"      PLEASE WAIT":PRINT:PRINT:PRINT:PRINT:PRINT:PRINT
80 FOR X=0 TO 24:READ Y:POKE256+X,Y:NEXT
85 SYS 256
90 DATA 162,1,160,255,32,186,255,169,0,32,189,255,162,255
100 DATA 160,255,32,213,255,76,10,25,0,0,0,0
READY.
```

PSYCLAPSE

COMMODORE 64

&

BANDERSNATCH

48K SPECTRUM

PROGRESS REPORT...............

It was only a few short weeks ago that (from left to right) Ian Weatherburn, John Gibson, Eugene Evans and Mike Glover were given their original brief.....'Produce the two most exhilarating computer games ever'.

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Sandwiches consumed	Ham	204
	Cheese & Tomato	314
	Salad	353½ (Eugene didn't like one of his)

..the name of the game

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(continued from page 81)

Remove cassette but do not rewind then type:

NEW

Followed by

LOAD "",1,1

Change back to the final cassette and type

SAVE "",1,1

You should now have a copy.

Control is by joystick only. The first level is relatively easy and it is a good idea to clear some of the mushroom patch first. Shooting a mushroom scores 1 point and clearing a mushroom scores 10 points. Once the spider arrives, kill it quickly. It is extremely good at killing you and scores 600 points.

If you are unable to enter Millipods but would like a copy, then please send £3.50 to: Millipods Offer, 62 Tamworth Road, Amington, Tamworth, Staffs B77 3BU.

Listing 2.

```
5 L$="0123456789ABCDEF"
10 OPEN2,0
15 PRINT"          MENU"
17 PRINT
20 PRINT"1... ENTER DATA":PRINT
30 PRINT"2... CHECK DATA":PRINT
40 PRINT"3... SAVE DATA":PRINT
50 PRINT"4... LOAD DATA":PRINT
60 INPUT#2,A$:PRINT
70 IFVAL(A$)=0THEN60
80 A=VAL(A$)
90 IFA<1ORA>4THEN60
100 ONAGOTO500,1000,1500,2000
200 B$=LEFT$(A$,1)
210 IFVAL(B$)=0THENA=ASC(B$)-55:GOTO230
220 A=VAL(B$)
230 C=A*1
240 B$=RIGHT$(A$,1)
250 IFVAL(B$)=0THENA=ASC(B$)-55:GOTO270
260 D=VAL(B$)
270 A=C+D:RETURN
300 A=INT(PEEK(SS)/16)+1:B=(PEEK(SS)AND15)+1
310 A$=MID$(L$,A,1)+MID$(L$,B,1)
320 RETURN
400 GETA$:IFA$=""THEN400
410 IFA$="*"THEN15
420 SC=0:RETURN
500 PRINT:PRINT:PRINT:PRINT"INPUT START"
510 INPUT#2,SS:PRINT
520 PRINTSS;:INPUT#2,A$:PRINT:IFA$="*"THEN15
530 GOSUB200
540 POKESS,A:SS=SS+1
550 IFSS=7679THEN15
560 GOTO520
1000 PRINT"INPUT START"
1010 INPUT#2,SS:PRINT
1020 SC=0
1030 PRINTSS;
1040 GOSUB 300
1050 PRINTA$
1060 SS=SS+1:SC=SC+1:IFSC>=20THENGOSUB400
1070 IFSS=7679THEN15
1080 GOTO1030
1500 POKE780,1:POKE781,1:POKE782,255:SYS65466
1510 POKE780,0:SYS65469
1520 POKE780,0:POKE781,255:POKE782,29:POKE0,4
     :POKE1,16:SYS65496
1530 GOTO15
2000 PRINT:PRINT"LOADING"
2010 POKE780,1:POKE781,1:POKE782,3:SYS65466
2020 POKE780,0:SYS65469
2030 POKE782,16:POKE781,0:POKE780,0:SYS65493
2040 GOTO15
```

```
4100 A9 00 8D 13 91 A9 7F 8D 22 91
4110 AC 11 91 98 29 20 F0 5E 98 29
4120 10 D0 03 CE BC 02 AD 20 91 29
4130 80 D0 03 EE BC 02 98 29 04 D0
4140 09 AD BC 02 38 E9 14 8D BC 02
4150 98 29 08 D0 09 AB BC 02 18 69
4160 14 8D BC 02 AD BC 02 10 03 18
4170 69 14 30 FB C9 50 90 03 38 E9
4180 14 8D BC 02 AA AC BD 02 BD A4
4190 1F C9 07 90 03 4C 64 19 A9 02
4200 99 A4 1F A9 00 99 A4 97 4C CE
4210 13 60 AD C2 02 F0 01 60 AD BC
4220 02 18 69 7C 8D C1 02 A8 A9 01
4230 8D C2 02 A9 01 99 14 1F A9 01
4240 99 14 97 A9 14 85 57 85 59 A9
4250 1F 85 58 A9 97 85 5A A9 BE 4C
4260 C6 11 60 AD C2 02 D0 01 60 AC
4270 C1 02 A9 00 91 59 A9 02 91 57
4280 98 38 E9 14 C9 EC 90 15 A8 A5
4290 58 C9 1F F0 09 A9 00 8D C2 02
4300 8D 0B 90 60 C6 58 C6 5A 98 8D
4310 C1 02 A8 B1 57 C9 02 F0 03 4C
4320 50 14 A9 01 91 57 A9 01 91 59
4330 EE 0B 90 EE 0B 90 EE 0B 90 60
4340 A9 FF 8D 05 90 8D 0E 90 A9 22
4350 8D 01 90 A9 94 8D 02 90 A9 B2
4360 8D 03 90 A9 0F 8D 00 90 A9 08
4370 8D 0F 90 20 30 11 20 68 11 A9
4380 1E 8D 5F 11 A9 96 8D 64 11 60
4390 00 00 00 00 00 00 00 00 00 00
4400 A9 02 A2 00 9D 00 1E 9D 00 1F
4410 E8 E0 00 D0 F5 A2 00 A0 00 98
4420 18 7D BC 1B 90 0F A8 EE 5F 11
4430 EE 64 11 AD 5F 11 C9 1F F0 01
4440 60 E8 A8 A9 06 99 00 1E A9 09
4450 99 00 96 4C 43 11 A2 14 BD EB
4460 1B 9D FF 1D A9 01 9D FF 95 CA
4470 D0 F2 60 A2 05 AD 0E 1E 18 6D
4480 BF 02 8D 0E 1E C9 16 90 EF FE
4490 08 1E 38 E9 0A C9 16 B0 F6 9D
4500 09 1E CA E0 FF F0 DD BD 09 1E
4510 4C 85 11 00 00 AD BC 02 18 69
4520 50 CD BB 02 B0 03 4C 52 17 AD
4530 BB 02 18 4C 72 18 00 00 00 00
4540 00 00 00 00 00 00 00 00 00 00
4550 8D 0B 90 AC 11 91 4C 16 10 00
4560 00 00 00 00 00 00 00 00 00 00
4570 AD A8 02 C9 0C 90 05 A9 0C 8D
4580 A8 02 4C 72 13 00 00 00 00 00
4590 00 00 AD A8 02 D0 03 4C 1E 19
4600 AD AD 02 18 69 03 A8 B9 70 17
4610 85 5D B9 71 17 85 5E A9 1F A0
4620 00 91 5D 60 37 00 00 C9 00 F0
4630 03 4C 6A 13 4C 64 19 00 00 00
4640 AC AD 02 B9 70 17 18 79 70 17
4650 38 E9 00 AA 18 6D AD 02 A8 B9
4660 72 17 99 74 17 88 CA D0 F6 60
4670 00 00 00 00 00 00 00 00 00 00
4680 A9 1E 85 5E AC AD 02 B9 72 17
4690 C9 B4 B0 51 18 2A 85 5D 90 02
4700 E6 5E B9 71 17 18 79 83 17 C9
4710 14 B0 39 8D AF 02 A5 5D 18 6D
4720 AF 02 90 02 E6 5E 85 5D A2 00
4730 A1 5D C9 02 D0 2B A9 1E 81 5D
4740 AD AF 02 99 71 17 A5 5D 99 73
4750 17 A5 5E 99 74 17 18 69 78 85
4760 5E A9 05 81 5D 60 00 00 00 00
4770 4C E8 12 00 00 4C 24 13 00 C9
4780 00 D0 F3 4C 64 19 00 00 00 00
```

(listing continued on page 84)

(listing continued from page 83)

```
4790 00 00 00 00 00 00 00 00 00 00
4800 AE AD 02 BD 70 17 38 7D 70 17
4810 18 6D AD 02 A8 B9 70 17 85 5D
4820 B9 71 17 85 5E A9 02 A0 00 91
4830 5D 60 00 00 00 00 00 00 00 00
4840 98 AA B9 72 17 18 69 0A 99 72
4850 17 B9 83 17 49 FE 99 83 17 B9
4860 73 17 18 69 14 99 73 17 85 5D
4870 90 03 FE 74 17 B9 74 17 85 5E
4880 A2 00 A9 1E 81 5D E6 5E 18 69
4890 78 85 5E A9 05 81 5D 60 00 00
4900 B9 71 17 18 79 83 17 8D AF 02
4910 C9 14 B0 38 85 5D A9 1F 85 5E
4920 B9 72 17 18 2A 18 65 5D 85 5D
4930 A2 00 A1 5D C9 02 D0 1D A9 1E
4940 81 5D A9 97 85 5E A9 05 81 5D
4950 AD AF 02 99 71 17 A9 1F 99 74
4960 17 A5 5D 99 73 17 60 4C 13 12
4970 B9 83 17 49 FE 99 83 17 B9 72
4980 17 18 79 82 17 99 72 17 C9 B3
4990 90 26 C9 F9 B0 22 18 2A 18 79
5000 71 17 85 5D 99 73 17 A9 1F 85
5010 5E 99 74 17 A9 1E A2 00 81 5D
5020 A9 97 85 5E A9 05 81 5D 60 00
5030 B9 82 17 C9 0A F0 04 A9 0A D0
5040 02 A9 F6 99 82 17 B9 72 17 18
5050 79 82 17 99 72 17 B9 70 17 C9
5060 01 B0 46 4C 72 13 14 00 00 00
5070 8E BD 02 A9 00 9D A4 1F A9 06
5080 9D A4 97 60 00 00 00 00 00 00
5090 A9 00 8D A9 02 8D AD 02 20 F0
5100 11 20 C0 12 20 20 12 20 48 12
5110 EE A9 02 AD A9 02 CD A8 02 F0
5120 DA AD AD 02 18 69 14 8D AD 02
5130 4C EA 13 AC A8 02 A9 00 18 69
5140 14 88 D0 FA A8 EE A8 02 A9 1F
5150 99 74 17 99 76 17 A9 68 99 73
5160 17 99 75 17 A9 01 99 83 17 A9
5170 0A 99 82 17 A9 B4 99 72 17 A9
5180 00 99 71 17 A9 01 99 70 17 AC
5190 AD 02 4C DA 11 00 00 00 00 00
5200 C9 07 90 24 C9 1E D0 03 4C 54
5210 15 C9 1F D0 03 4C 44 16 4C B0
5220 18 00 00 00 00 A9 A0 8D 0D 90
5230 A9 00 8D C2 02 8D 0B 90 60 00
5240 48 C9 03 D0 04 A9 0A D0 02 A9
5250 01 8D BF 02 20 79 11 68 38 E9
5260 01 91 57 A9 00 8D C2 02 4C 69
5270 14 00 00 00 00 00 00 00 00 00
5280 A9 00 8D B8 02 8D B9 02 8D D4
5290 02 98 18 69 14 90 02 E6 58 85
5300 57 A0 00 A2 00 A5 57 D9 73 17
5310 F0 17 C8 C8 E8 E0 07 F0 03 4C
5320 B9 14 AD B8 02 18 69 14 8D B8
5330 02 A8 4C B7 14 A5 58 D9 74 17
5340 D0 E2 8E B9 02 60 00 00 00 00
5350 AE B8 02 DE 70 17 BC 70 17 BD
5360 75 17 9D 73 17 BD 76 17 9D 74
5370 17 E8 E8 88 D0 EF AE B8 02 BD
5380 71 17 38 FD 83 17 9D 71 17 4C
5390 69 14 00 00 00 00 00 00 00 00
5400 CE A8 02 A0 00 AD B8 02 F0 07
5410 38 E9 14 C8 4C 20 15 8C D4 02
5420 AD A8 02 38 ED D4 02 8D D4 02
5430 AC B8 02 A2 14 B9 84 17 99 70
5440 17 C8 CA D0 F6 CE D4 02 D0 EF
5450 4C 69 14 00 00 00 00 00 00 00
5460 20 A0 14 AD B8 02 8D AD 02 20
5470 C0 12 A9 DC 8D BF 02 20 79 11
5480 A9 06 A0 00 91 57 A5 58 18 69
5490 78 85 58 A9 09 91 57 AC B8 02
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5550 AC A8 02 A9 00 18 69 14 88 D0
5560 FA AA 8D D4 02 EE A8 02 AC B8
5570 02 B9 70 17 38 ED B9 02 38 E9
5580 01 9D 70 17 0A 18 69 02 8D D5
5590 02 B9 82 17 9D 82 17 B9 83 17
5600 9D 83 17 AD B9 02 0A 18 6D B8
5610 02 A8 B9 75 17 9D 73 17 C8 E8
5620 CE D5 02 D0 F3 A9 00 8D D5 02
5630 AE D4 02. BC 74 17 C0 1E F0 0D
5640 A9 0C 8D D5 02 BD 73 17 18 69
5650 10 D0 03 BD 73 17 C9 14 90 09
5660 38 E9 14 EE D5 02 4C 18 16 9D
5670 71 17 A9 00 AC D5 02 F0 06 18
5680 69 0A 88 D0 FA 9D 72 17 4C 90
5690 15 00 00 00 00 00 00 00 00 00
5700 20 A0 14 AC B8 02 8C AD 02 20
5710 C0 12 A9 64 8D BF 02 20 79 11
5720 A9 06 A0 00 91 57 A5 58 18 69
5730 78 85 58 A9 09 91 57 AC B8 02
5740 BE 70 17 CA EC B9 02 F0 03 4C
5750 AE 15 AE B8 02 DE 70 17 4C 69
5760 14 4C 62 17 00 00 00 00 00 00
5770 8A A0 00 C9 14 90 07 38 E9 14
5780 C8 4C 8D 16 8C D5 02 8D D4 02
5790 60 AC BB 02 4C 28 17 4C A3 11
5800 AE BC 02 20 8A 16 8D D6 02 AE
5810 BB 02 20 8A 16 CD D6 02 F0 E9
5820 B0 04 A9 15 D0 02 A9 13 8D D5
5830 02 AD BB 02 18 6D D5 02 C9 A0
5840 B0 AF 8D BA 02 4C DA 16 00 00
5850 AC BB 02 AD CD 02 99 54 1F AD
5860 CE 02 99 55 1F A9 09 99 54 97
5870 99 55 97 AC BA 02 B9 54 1F D0
5880 03 4C 64 19 C9 1D B0 9F EA C9
5890 01 D0 03 4C B0 18 8D CD 02 B9
5900 55 1F D0 03 4C 64 19 C9 1D B0
5910 88 EA C9 01 D0 03 4C B0 18 8D
5920 CE 02 AC BA 02 8C BB 02 A9 20
5930 99 54 1F A9 21 99 55 1F A9 02
5940 99 54 97 99 55 97 60 4C A3 11
5950 AE BC 02 20 8A 16 8D D6 02 AE
5960 BB 02 20 8A 16 CD D6 02 F0 E9
5970 AD BB 02 38 E9 14 C9 A1 B0 0C
5980 8D BA 02 4C DA 16 A9 01 8D D1
5990 02 60 A9 00 8D D1 02 60 00 00
6000 04 0E 14 36 1E 37 1E 38 1E 39
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6250 A9 01 8D D1 02 4C 02 18 69 14
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6270 A9 01 8D D1 02 4C 3E 17 00 00
6280 AD CC 02 F0 04 CE CC 02 60 AD
6290 BB 02 4A 18 69 82 8D 0A 90 EE
6300 CF 02 AD D1 02 D0 03 4C A8 16
6310 4C 3E 17 00 00 00 00 00 00 00
6320 A0 03 A9 C8 8D BF 02 20 79 11
6330 88 D0 F5 AC BB 02 AD CD 02 99
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6580 A2 00 A0 00 AD A8 02 8D D6 02
6590 B9 44 1B 9D 71 17 B9 45 1B 9D
6600 72 17 B9 46 1B 9D 83 17 A9 0A
6610 9D 82.17 8A 18 69 14 AA 98 18
6620 69 03 A8 CE D6 02 D0 DA EE EA
6630 02 AD EA 02 C9 10 F0 17 AD 0E
6640 90 38 E9 10 8D 0E 90 AD EE 02
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6660 1A A9 FF 8D 0E 90 A9 01 8D EA
6670 02 4C F1 19 AC BB 02 AD CD 02
6680 99 54 1F AD CE 02 99 55 1F A9
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6710 8D D6 02 A2 00 A0 00 88 D0 FD
6720 CA D0 FA CE D6 02 D0 F5 60 00
6730 A9 00 8D 0A 90 8D 0B 90 8D 0C
6740 90 8D 0D 90 4C 5E 1A AE D6 02
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7330 42 3C 42 42 3C 00 3C 42 42 3E
7340 02 04 38 00 43 63 51 49 45 63
7350 61 61 7E 40 40 78 40 60 60 7E
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7380 61 61 61 61 7F 41 41 7F 41 61
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7400 7F 41 41 7F 48 64 62 61 3C 7E
7410 CF FF FF CF 7E 3C 3C 7E FF FF
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7430 09 10 88 D4 A2 B9 E4 E2 90 08
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7650 60 00 00 00 00 00 00 00 00 00
7660 00 00 00 00 00 00 00 00 D0 00
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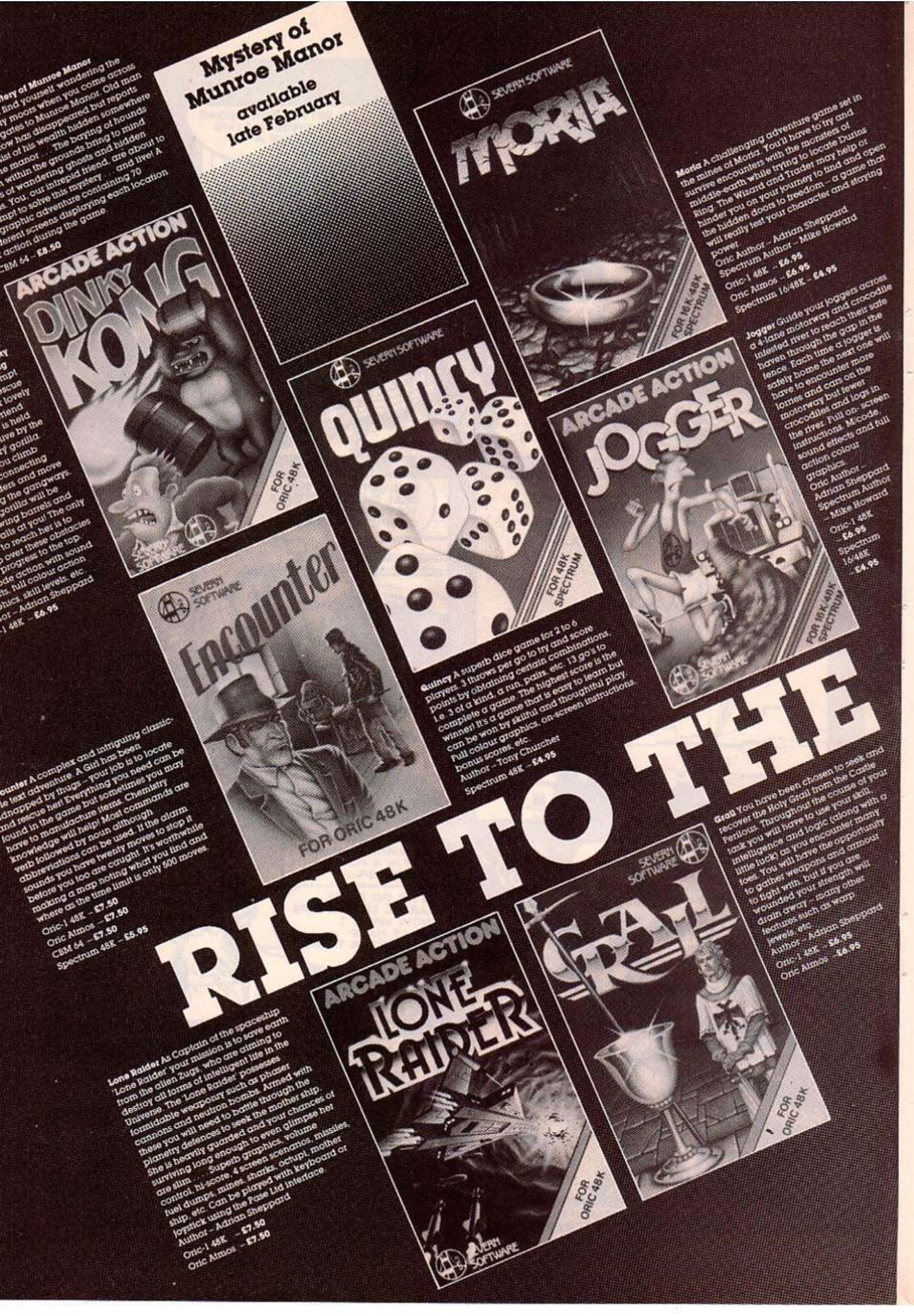

Mystery of Munroe Manor
available late February
ry of Munroe Manor
find yourself wandering the
y moors when you come across
gates to Munroe Manor. Old man
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e manor ... The baying of hounds
within the grounds bring to mind
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s. You, our intrepid friend, are about to
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graphic adventure containing 70
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ARCADE ACTION
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SEVERN SOFTWARE
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Moria A challenging adventure game set in the mines of Moria. You'll have to try and survive encounters with the monsters of middle-earth while trying to locate Durins Ring. The Wizard and Trader may help or hinder you on your journey to find and open the hidden doors to freedom – a game that will really test your character and staying power.
Oric Author – Adrian Sheppard
Spectrum Author – Mike Howard
Oric-1 48K – £6.95
Oric Atmos – £6.95
Spectrum 16/48K – £4.95
QUINCY
FOR 48K SPECTRUM
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JOGGER
FOR 16K/48K SPECTRUM
Jogger Guide your joggers across a 4-lane motorway and crocodile infested river to reach their safe haven through the gap in the fence. Each time a jogger is safely home the next one will have to encounter more lorries and cars on the motorway but fewer crocodiles and logs in the river. Full on-screen instructions. M/code, sound effects and full action colour graphics.
Oric Author – Adrian Sheppard
Spectrum Author – Mike Howard
Oric-1 48K – £6.95
Spectrum 16/48K – £4.95
orist A1 48K – £6.95
ENCOUNTER
FOR ORIC 48K
Quincy A superb dice game for 2 to 6 players. 3 throws per go to try and score points by obtaining certain combinations, i.e. 3 of a kind, a run, pairs, etc. 13 go's to complete a game. The highest score is the winner! It's a game that is easy to learn but can be won by skilful and thoughtful play. Full colour graphics, on-screen instructions, bonus scores, etc.
Author – Tony Churcher
Spectrum 48K – £4.95
ounter A complex and intriguing classic
le text adventure. A Girl has been
dnapped by thugs – your job is to locate
and rescue her! Everything you need can be
found in the game but sometimes you may
have to manufacture items. Chemistry
knowledge will help! Most commands are
verb followed by noun although
abbreviations can be used. If the alarm
sounds you have twenty moves to stop it
before you too are caught! It's worthwhile
making a map noting what you find and
where as the time limit is only 600 moves.
Oric-1 48K – £7.50
Oric Atmos – £7.50
CBM 64 – £7.50
Spectrum 48K – £5.95
RISE TO THE
Grail You have been chosen to seek and recover the Holy Grail from the Castle Perilous. Throughout the course of your task you will have to use your skill, intelligence and logic (along with a little luck) as you encounter many foes. You will have the opportunity to gather weapons and armour to fight with, but if you are wounded your strength will drain away ... many other features such as warp jewels, etc.
Author – Adrian Sheppard
Oric-1 48K – £6.95
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LONE RAIDER
FOR ORIC 48K
SEVERN SOFTWARE
GRAIL
FOR ORIC 48K
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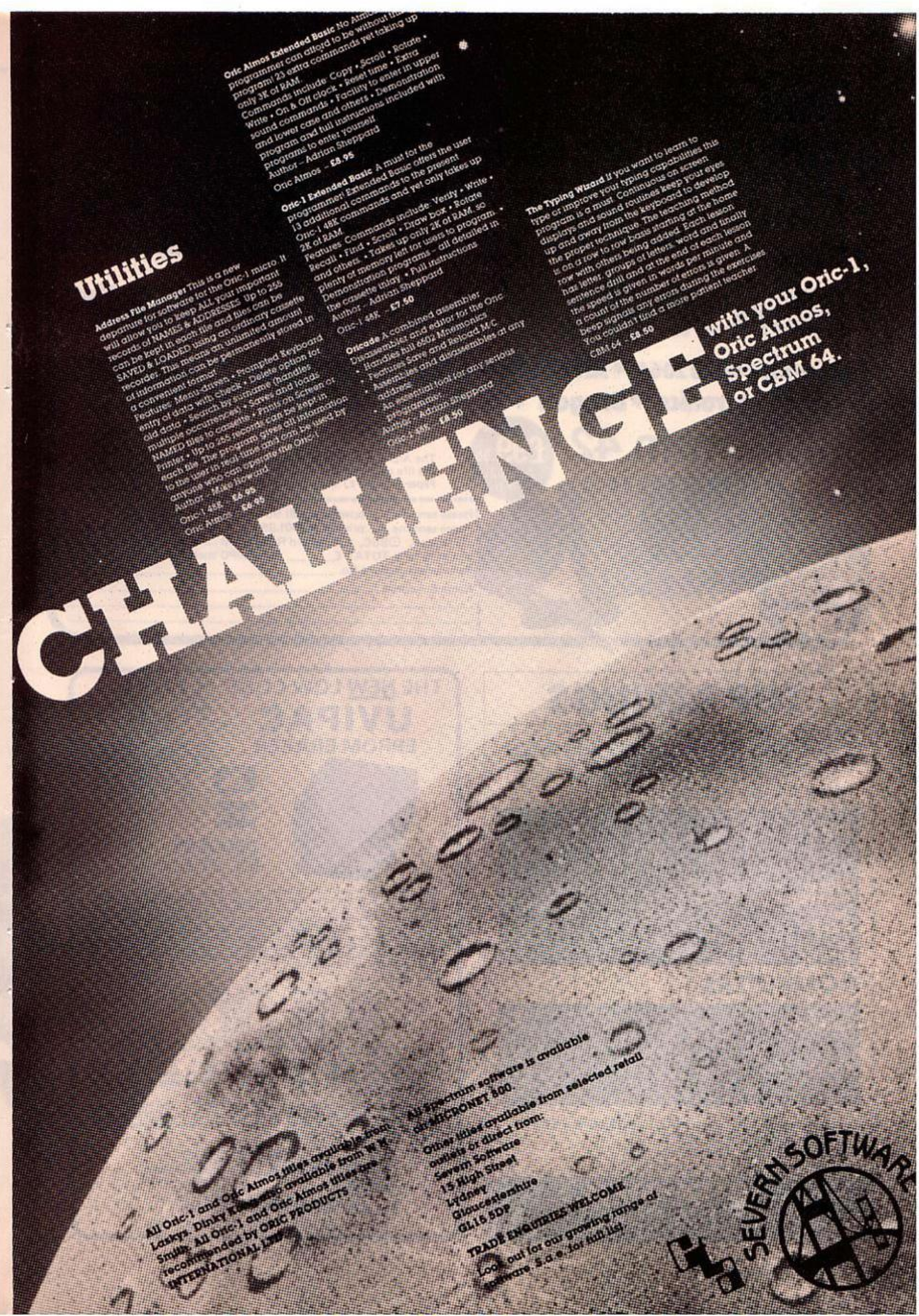
Oric Atmos – £7.50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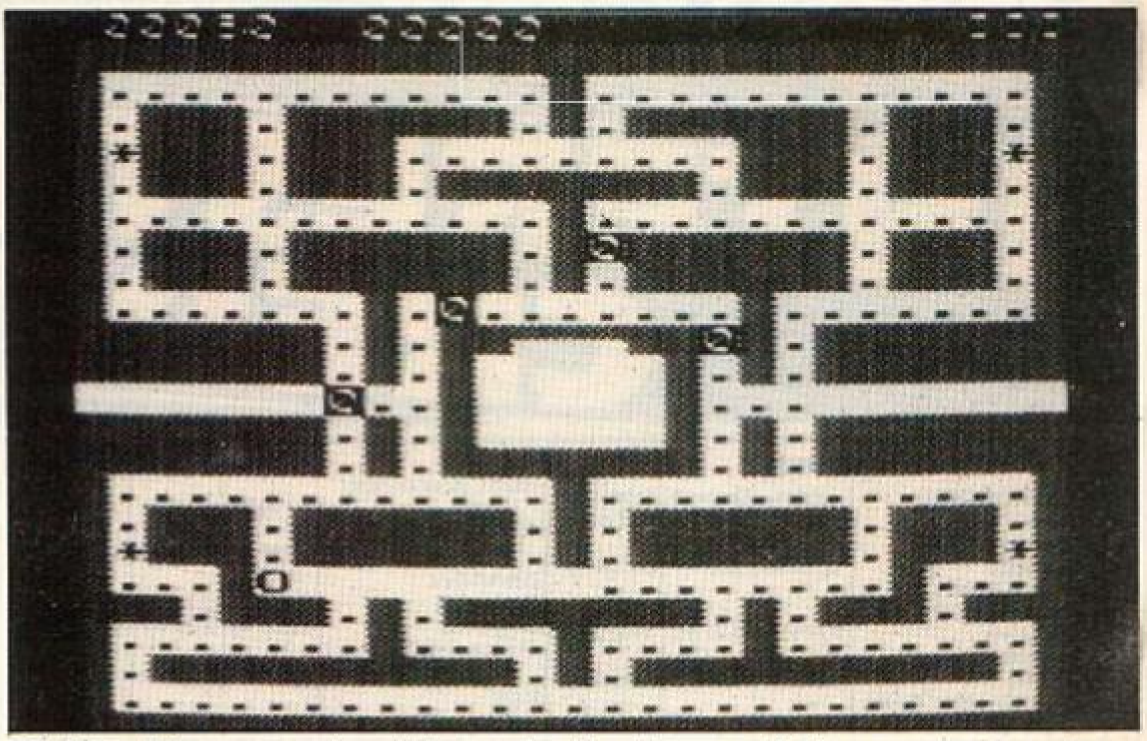
Hex loader.

```
  12■REM
  50 GOTO 7000
  70 SAVE "PA■"
 100 RAND USR 16611
6997 REM HEX LOADER
6998 STOP
6999 REM *** WRITE ***
7000 CLS
7010 PRINT "READ OR WRITE? (R/W)
"
7020 INPUT M$
7030 PRINT "START ADDRESS"
7040 INPUT S
7050 PRINT "FINISH ADRESS"
7060 INPUT F
7070 IF M$="R" THEN GOTO 8000
7080 FOR N=S TO F STEP 8
7090 LET T=0
7100 PRINT N;" - ";
7110 INPUT A$
7120 PRINT A$;" = ";
7130 INPUT TOT
7140 PRINT TOT
7145 LET Z=0
7150 FOR K=1 TO LEN A$ STEP 2
7160 LET C=(CODE A$(K)-28)*16+CO
DE A$(K+1)-28
7170 LET T=T+C
7180 POKE N+Z,C
7190 LET Z=Z+1
7200 NEXT K
7210 IF TOT=T THEN GOTO 7240
7220 SCROLL
7225 PRINT "ERROR - PLEASE INPUT
 AGAIN"
7230 GOTO 7090
7240 NEXT N
7250 STOP
7999 REM *** READ ***
8000 FOR N=S TO F STEP 8
8005 SCROLL
8010 PRINT N;" - ";
8020 FOR B=0 TO 7
8030 LET C=PEEK (N+B)
8040 LET F$=CHR$ (INT (C/16+28))
8050 LET S$=CHR$ ((C-((CODE F$-2
8)*16))+28)
8055 PRINT F$;S$;
8060 NEXT B
8070 PRINT
8080 NEXT N
```



Philip Harwood with a derivation of the game we all know and love.

PAC-81

PAC 81 ALLOWS A 16K ZX-81 to be used to play an almost authentic version of the popular arcade game Pac-Man. Four independent ghosts which will follow patterns, move randomly and actually chase you; with random fruit appearing, flashing ghosts, eyes which run back to the next when ghosts are eaten, power pills, on-screen scoring, high score, extra man, eight levels of play ranging from slow and easy, to very fast and nearly impossible to escape from the ghosts.

The game is just under 3K of machine code, and with a little patience and persistance should not pose any real problems. The code is entered in hexadecimal and can be written, checked and listed by the hex loader given.

The machine code is stored in Rem statements at the beginning of the program. This means that the start address for the machine code is 16514. Ten Rem statements are used and these should be created first using any characters so that they have lengths according to table 1. The edit facility can be useful here and could save time. Also in table 1 are the first and last addresses for each of the Rem statements, this allows the lengths to be checked by Poking these addresses with 128, listing the line and seeing that black squares are now at either end of them. For example: create a line

1 REM with 378 characters

now

POKE 16514,128 and POKE 16891,128

List 1 should show black squares in the first and last positions of this statement. If not then edit the line accordingly. Repeat this for all 10 lines.

Now enter in the hex loader, this allows the code to be entered and checked, line by line. Enter the code for Rem 1 and Save all this onto a cassette. It is worthwhile always saving machine code before calling it as correcting typing errors is quicker than retyping the whole statement should the program crash.

The program should be entered one Rem statement at a time and tested. Table 2 shows how to test each routine. Enter the corresponding lines of Basic

(continued on page 91)

Rem 1.

```
16514 - 46000C53000C9000 = 321
16522 - 09CA000CD7000C2D = 495
16530 - 01073501093F0107 = 142
16538 - 960103A00103F301 = 562
16546 - 0C00020C5602035A = 207
16554 - 02116C0203980207 = 293
16562 - A00204A50204AA02 = 509
16570 - 07DA02198F0107A3 = 566
16578 - 01077901059A0105 = 295
16586 - BB01055901038800 = 422
16594 - 01A000013502014D = 295
16602 - 02017B01019B0103 = 287
16610 - 620201676B72747B = 664
16618 - 7F8C9CA9ADB1B9BD = 1316
16626 - C1EBEFF6F8FF030C = 1431
16634 - 101719202454565E = 396
16642 - 6075777F81B7B9C1 = 1149
16650 - C3D8DA62E414181F = 1158
16658 - 21282C3940424979 = 498
16666 - 7D7F87898DB9C4C6 = 1244
16674 - D12A0C40230E1806 = 406
16682 - 1F36802310FB2323 = 585
16690 - 0D20F4C92A0C4011 = 625
16698 - 2400190E17061B36 = 185
16706 - 082310FB11060019 = 358
16714 - 0D20F2C9D11A13D5 = 955
16722 - FEFFC8772318F55E = 1226
16730 - 2356234 6E52A0C40 = 573
16738 - 19772310FCE123C9 = 908
16746 - 5EE52A0C4019361B = 547
16754 - E123C92182400E14 = 722
16762 - 3E1BCD59410D20FA = 743
16770 - 0E053E00CD59410D = 453
16778 - 20FA3E0ACD59410E = 727
16786 - 043E17CD59410D20 = 493
16794 - FA0E023E9CCD5941 = 843
16802 - 0D20FA3E34CD5941 = 768
16810 - C921E54006131600 = 574
16818 - CD6A4110FB061716 = 694
16826 - 01CD6A4110FB0614 = 670
16834 - 1602CD6A4110FBC9 = 868
16842 - CD2341CD36412A0C = 683
16850 - 40232323CD4E4180 = 645
16858 - 9C9C9C9C9C80809C = 1192
16866 - 9DA5A39C80808080 = 1153
16874 - 80808080808080B4 = 1076
16882 - B4B4FFCD7541CDAB = 1378
16890 - 41C9 = 266
```

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(continued from page 89)

and Run 100. Keep to this line numbering as it gradually builds up a program showing how the program is developed. If a line number is duplicated, it means that it is replacing a pervious command.

Rem 1 creates the screen display of the maze and is drawn by the single Rand USR 16842 statement. If it does not make a complete maze then a mistake has been, made so check the data.

Moving the man is dealt with in Rem 2. Enter this data and the test program — do not delete line 100.

Run 100 and a circle should appear. This is your man. He is controlled by the keys A — Up, Z — down, N — left and M — right. The movement here is very quick, but it will be slowed down in the main game.

Moving the ghosts is done in two stages, Rems 3 and 4. Enter Rem 3. When the test program is Run, one ghosts — an inverse zero — should rapidly move to the top right hand corner of the maze and circle about here until the break key is pressed.

The controlling of the ghosts is held in Rem 4, enter this code. Before running also enter the data for Rem 9 — addresses 18790 to 18980 — this will reset all the ghosts and the man to their original positions. Enter and run the test program for Rem 4; note that most of the previous test routines are either changed or deleted. All four ghosts should now

(continued on page 93)

Rem 2.

```
16898 - 610203031BCDBB02 = 526
16906 - CB4D20033E01C9CB = 732
16914 - 4520033E02C9CB7D = 697
16922 - 200ECB6420033E03 = 449
16930 - C9CB5C20033E04C9 = 793
16938 - 3A0442C9FE00C8FE = 1037
16946 - 0120071121000A7ED = 491
16954 - 52C9FE0220051121 = 626
16962 - 0019C9FE03200225 = 560
16970 - C923C9ED5B02422A = 875
16978 - 0C4019C9ED5B0C40 = 706
16986 - A7ED527DFE8E2004 = 1043
16994 - 2EA918022E8F19C9 = 656
17002 - CD0742CD4D42CD2E = 877
17010 - 423205427EFE0828 = 615
17018 - 0BFE0A2807FE80CC = 908
17026 - 56421824CD4D423A = 618
17034 - 0442CD2E42320542 = 508
17042 - 7EFE08280BFE0A28 = 743
17050 - 07FE80CC56421808 = 777
17058 - 3E00320542CD4D42 = 531
17066 - E5CD4D423600E17E = 982
17074 - 320642363 4ED5B0C = 568
17082 - 40A7ED522202423A = 710
17090 - 054232044 2C9 = 392
```

Rem 3.

```
17102 - 9D0100000000009C = 314
17110 - 00ED5BCE422A0C40 = 718
17118 - 19C932D242FE0120 = 839
17126 - 083AD042FE02C818 = 820
17134 - 22FE022008 3AD042 = 662
17142 - FE01C81816FE0320 = 790
17150 - 083AD042FE04C818 = 822
17158 - 0AFE0420063AD042 = 638
17166 - FE03C87EFE802005 = 1002
17174 - CD56421814FE0A20 = 697
17182 - 0D3AD442FE01C83E = 866
17190 - 0132D4421803FE08 = 618
17198 - C8D1115C43D5C93A = 1057
17206 - 0142CDD742CD2E42 = 1078
17214 - CDE0423AD042CDD7 = 1247
17222 - 42CD2E42CDE04206 = 884
17230 - 0478CDD742CD2E42 = 927
17238 - CDE04210F4C9E5CD = 1390
17246 - D7423AD34277E17E = 1086
17254 - 32D3423AD54277ED = 1020
17262 - 5B0C40A7ED5222CE = 893
17270 - 423AD24232D042C9 = 925
```

Rem 4.

```
17284 - 5A0101010 10A019C = 261
17292 - 0101CC4302019B01 = 432
17300 - 00000000009C0101 = 158
17308 - E04302029C010000 = 452
17316 - 0000009C0101F443 = 469
17324 - 05039D0100000000 = 166
17332 - 009C010108440504 = 244
17340 - 9D0100000000009C = 314
17348 - 0101084406040102 = 91
17356 - 0309010C030F0103 = 47
17364 - 0404011104070103 = 41
17372 - 03FF000201030408 = 276
17380 - 0204041C01070303 = 52
17388 - 0105040401FF0005 = 275
17396 - 0103030302060405 = 27
17404 - 03040207030F010B = 46
17412 - 03FF000601170207 = 297
17420 - 0407031001 0A0410 = 61
17428 - 020D030201FF0904 = 289
17436 - 0C163AC8433D200D = 465
17444 - 2AC6437E32BF4323 = 776
17452 - 7E2322C64332C843 = 777
17460 - 3E00C93A34400604 = 447
17468 - 9030FD30FE002001 = 860
17476 - 3C32BF433E00C921 = 664
17484 - C543352005 3602C3 = 605
17492 - 3744E121FD44E5C9 = 1132
17500 - C543C91121000600 = 521
17508 - A7ED52047CFE0020 = 900
17516 - F77D04D62130FB05 = 927
17524 - C6216768C92A0242 = 749
17532 - CD5F44221A442ABC = 726
17540 - 43CD5F44221C443A = 623
17548 - BE43FE012804FE02 = 812
17556 - 20123A1D44473A1B = 361
17564 - 44B83804 3E041814 = 422
17572 - 3E0318103A1C4447 = 330
17580 - 3A1A44B838043E02 = 460
17588 - 18023E0132BF433E = 459
17596 - 00C921844306 04C5 = 640
17604 - 010E00118C43EDB0 = 700
17612 - E53AC443FE01CC1E = 1039
17620 - 44FE02CC3744FE03 = 908
17628 - CC7944FE04CC4B44 = 998
17636 - 218C4311CE420108 = 586
17644 - 00EDB0CD5C4521CE = 1018
17652 - 42118C430108 00ED = 584
17660 - B0D1D521C9431B01 = 927
17668 - 0E00EDB8E1C110B7 = 1052
17676 - C9 = 201
```

Table 1. Lengths of Rem statements.

Rem	Length	Start add	End add	Main topic
1	378	16514	16891	draw the maze
2	198	16898	17095	move the man
3	176	17102	17277	move a ghost
4	393	17284	17676	control the ghosts
5	227	17683	17909	subroutines 1
6	351	17916	18266	return eyes to nest
7	239	18273	18511	subroutines 2
8	266	18518	18783	main controller
9	191	18790	18980	reset variable
10	240	18987	19226	end routines.

Table 2. Test routines.

REM 1

```
100 RAND USR 16842
```

REM 2

```
101 POKE 16898,98
102 POKE 16899,2
103 POKE 16900,3
1010 RAND USR 17002
4000 GOTO 1010
```

REM 3

```
111 POKE 17102,123
112 POKE 17103,1
113 POKE 17105,1
114 POKE 17108,0
115 POKE 17109,156
1020 RAND USR 17205
```

REM 4

(Enter REM 9 before running)
delete 101, 102, 103

```
111 POKE 18891,201
112 RAND USR 18853
113 POKE 17648,53
114 POKE 17649,67
115 POKE 17292,1
116 POKE 17306,2
117 POKE 17320,3
118 POKE 17334,4
1020 RAND USR 17598
```

REM 5

```
111 POKE 18891,205
113 POKE 17648,92
114 POKE 17649,69
1025 RAND USR 17790
```

REM 6

```
120 POKE 17291,139
121 POKE 17305,139
1015 RAND USR 17917
1025 RAND USR 17917
1050 IF PEEK 17916 = 1 THEN STOP
```

REM 7

```
130 POKE 18430,3
132 POKE 18431,0
135 POKE 18468,1
1030 RAND USR 18274
1040 RAND USR 18327
1045 RAND USR 18432
1047 RAND USR 18469
1060 RAND USR 18400
1065 IF PEEK 18273 = 1 THEN RAND
     USR 17832
```

REMS 8 and 10

Delete all previous Basic tests

```
100 RAND USR 19011
```

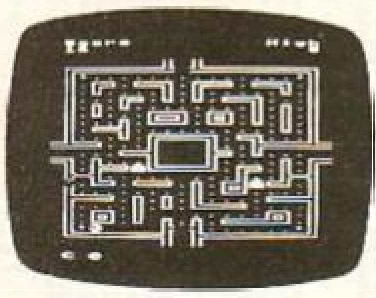
Rem 5.

```
17683 - 218941306047EFE9C = 733
17691 - 2808FE8B2807110E = 522
17699 - 001910F1C9E51105 = 734
17707 - 00A7ED521184430E = 716
17715 - 041ABE231320171A = 355
17723 - BE2013D513131313 = 530
17731 - 1AD1FE9C2808FE8B = 1086
17739 - 2804E17718D0C506 = 823
17747 - 0D1310FD2BC10D20 = 562
17755 - D8CD3543CD1345C9 = 1035
17763 - 1801170A150A1414 = 132
17771 - 13231132184B0F64 = 335
17779 - 0C960DC88B280000 = 554
17787 - 9C00003A06422163 = 416
17795 - 45BE28042323 18F9 = 646
17803 - 237EFE00C8472A0C = 740
17811 - 40110700197E3CFE = 553
17819 - A620063E9C772B18 = 608
17827 - F47710EAC90632C5 = 1067
17835 - 2A0C400E18051F23 = 228
17843 - 7EC6807710F92323 = 906
17851 - 0D20F2C110E9C9D5 = 1143
17859 - 1100001D20FD1520 = 384
17867 - FA3D20F4D1C9CDF5 = 1447
17875 - 413E01CDC2452A0C = 650
17883 - 40118102 19CD4E41 = 585
17891 - B7AAA6A9BEFF3E01 = 1196
17899 - CDC2450605 2B3608 = 534
17907 - 10FBC9 = 468
```

Rem 6.

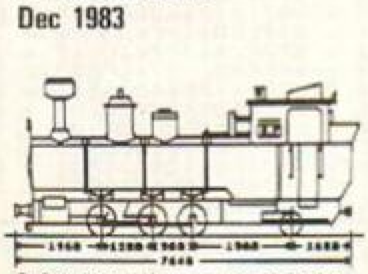
```
17916 - 0021024211844306 = 323
17924 - 041ABE231320041A = 336
17932 - BE280A0E0D130D20 = 331
17940 - FC2B10EDC9131313 = 886
17948 - 1313131AFE9C2006 = 531
17956 - 3E0132FC45C9CD39 = 897
17964 - 450E0718E0CA43DE = 830
17972 - 43F24306 44C5E5D5 = 1059
17980 - 06071B10FDEB118C = 749
17988 - 43010E00EDB021C1 = 721
17996 - 433834CD4D4721C2 = 753
18004 - 4336002 3360B1806 = 251
18012 - 217B01CD544721BC = 738
18020 - 4311CE42010800ED = 602
18028 - B0CD354321CE4211 = 823
18036 - 8C43010800EDB0ED = 914
18044 - 5BBC43217B01A7ED = 907
18052 - 527CFE0020057DFE = 876
18060 - 00280B1101061D20 = 136
18068 - FD1520FA18C221C2 = 1001
18076 - 43360023369C2336 = 455
18084 - 012323112F463AC9 = 464
18092 - 43471313 10FCEBED = 916
18100 - A0EDA0EB3601D1D5 = 1269
18108 - 08071B10FD21BC43 = 597
18116 - 010E00EDB0217845 = 650
18124 - 7E87773E08CD8145 = 984
18132 - D1E1C1C932BF43E5 = 1365
18140 - 2A0C40ED5BBC4319 = 726
18148 - CD2E427EFE08E1C8 = 1130
18156 - 3E0032BF43E1C921 = 828
18164 - 7B01CD5F44221A44 = 620
18172 - 2ABC43CD5F44221C = 727
18180 - 44211A443A1C44BE = 539
18188 - 38073E01CDD84618 = 641
```

(Rem 6 listing continued on page 93)



MUNCHMAN
October 1983

CHEQUERBOARD
Dec 1983



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December issue: Program Features: Killer Dice game, **Galactic Invasion**, a fast moving space invasion game, **LINK**, a very useful disc utility for program development, **ASTAAD**, a really excellent program for **Computer Aided Design**, the **Percussion Machine**, moving **Chequer Board** display, **Screen Freezer**, a routine to freeze your favourite game in mid-play, and a musical rendering of the **Twelve Days of Christmas to add a seasonal flavour. Plus articles on the Teletext Mode** (part 3) and **Fitting an External Speaker.** Plus **Disc Drive Reviews, Book Reviews,** Hints and Tips.

Jan/Feb issue: Program Features. Block Blitz, an excellent arcade style game. A **Disassembler for the BBC micro, the Ray Box game** to test your powers of deduction, **Large Digital Displays in Mode 7. Dancing Lines**, an interesting visual demonstration of random numbers. Plus articles on **Machine Code Graphics**, the first of an introductory series, **Teletext Mode** (Part 4) with a set of useful procedures, **Protecting your own programs**, and an **Introduction to forth.** Plus reviews of **Double Density Disk Controllers. Graphics Tablets, new Software, Product news,** Post bag. Hints and Tips.

STOP PRESS

BEEBUG has negotiated a deal with ACORN over the new 1.2 OPERATING SYSTEM ROM. BEEBUG members are offered the ROM at around half-price. See BEEBUG Feb. Issue for details.

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(continued from page 91)
move about the maze; one should move at half the speed of the others, one should move randomly. One should home in on the man while the other follows a pattern.

If two of the ghosts cross each other, a shadow is left, this is erased in Rem 5, the score should also appear. Things may seem a little odd at the moment, but providing it does not actually crash, press on.

Rem 6 brings in the gimmicks. When a ghosts is eaten, the eyes rush back to the nest to find a new body. If an inverse zero lands on you, the game should stop.

Fruit — or as best as Sinclair graphics allow — flashing ghosts, extra man at 10000 points, and half speed movement through the tunnels, along with a flashing screen when all the dots are eaten are added in Rem 7.

To complete the game, add Rems 8 and 10. Rem 9 should already be in. Delete all the previous Basic tests except the initial Rem statements, line by line. Rand USR 19011 should play the complete game.

(Rem 6 listing continued from page 91)

```
18196 - 053E02CDD846211B = 620
18204 - 443A1D44BE38063E = 537
18212 - 03CDD846C93E04CD = 966
18220 - D846C9ED5BBC437A = 1192
18228 - FE0120147BFE9620 = 866
18236 - 073E0432BF43D1C9 = 791
18244 - FEA220043E0318F3 = 784
18252 - C9CD2F47CDF346C9 = 1243
18260 - CD2F47CD7C44C9 = 921
```

Rem 7.

```
18273 - 002A0C4011460019 = 230
18281 - 0E1506197EFE18C8 = 673
18289 - FE17C82310F60608 = 788
18297 - 2310FD0D20EC0604 = 595
18305 - 218943110E007EFE = 643
18313 - 18C8FE17C81910F6 = 991
18321 - 3E01326147C90604 = 492
18329 - 218443E5237EFE01 = 877
18337 - 2B20117EFE952005 = 653
18345 - CD8D471807FEA320 = 945
18353 - 03CDD747E1110E00 = 750
18361 - 1910E0C923237EFE = 916
18369 - 0320071106001936 = 144
18377 - 04C9110500197EFE = 632
18385 - 9CC0233602C92323 = 710
18393 - 7EFE0420ED18E42A = 947
18401 - 0C40114600190E15 = 223
18409 - 06197EFE8B200236 = 638
18417 - 9C2310F606082310 = 518
18425 - FD0D20ECC903002A = 780
18433 - 0C402323232 37EFE = 596
18441 - 9DC021FF477EFE01 = 1069
18449 - C8360128344 62A0C = 474
18457 - 40111E00192B10FD = 448
18465 - 3684C90013A34402 1 = 643
18473 - 2443064690 30FD80 = 757
18481 - FE002817FE012801 = 613
18489 - C9462165452323 10 = 560
18497 - FC7E2A0C40116202 = 613
18505 - 1977C93E0018F3 = 674
```

The zero key can be used as a break key during most of the game. If this works, delete the hex loader and add the following:

```
50 GOTO 100
70 SAVE 'PAC'
100 RAND USR 19011
```

Run 70 to Save the game, this will auto-Run the program upon loading. If a title page is required Poke 19224,201. The program now returns to Basic at the end if every game, where a title page in Basic can be added. To play the game just call Rand USR 19011.

This program is available on a cassette, direct from the author, P Harwood, 12 Upper Glen Road, Bridge of Allan, Nr. Stirling. Cassette copies of Scram 81, a game based on scramble published in Nov/Dec issues of *Your Computer* are still available from the same address. The programs cost £3.50 and are sent return of post.

Rem 8.

```
18518 - 6364002156487EFE = 770
18526 - 002807353E02CC81 = 497
18534 - 48C9237EFE002807 = 735
18542 - 353E03CC8148C923 = 759
18550 - 7EFE0020E636322B = 789
18558 - 360AC9218C43110E = 536
18566 - 00060477191 0FCC9 = 623
18574 - 01003A0642FE1728 = 448
18582 - 0B3A8E48FE01201C = 598
18590 - CD5948C9218E4836 = 868
18598 - 0023366 43E04CD81 = 589
18606 - 483E8BCDDA483E0A = 840
18614 - 327845C9218F4835 = 741
18622 - 7EFE0FDCE0473A8F = 1111
18630 - 48FE00C03E03CD81 = 917
18638 - 483E9CCDDA483E01 = 848
18646 - 328E48C9218B4311 = 721
18654 - 0E000604771910FC = 436
18662 - C9CD6A42CDCA4A00 = 1059
18670 - 0000CDFD45CD9747 = 954
18678 - 3A0642FE8BC47E45 = 914
18686 - 3A0642FE1520142A = 499
18694 - 0C40111900193A24 = 237
18702 - 48472B10FD3A0642 = 585
18710 - C68077CDFF47CD25 = 1218
18718 - 48CD62473A6147FE = 926
18726 - 01CA2B4A3AFC45FE = 953
18734 - 01CAD74A2A0C4011 = 627
18742 - 7B01197EFE0B2002 = 574
18750 - 360011FF191D20FD = 665
18758 - 1520FACD904811FF = 996
18766 - 191D20FD1520FDCD = 850
18774 - BB02CB65C8C3E748 = 1191
18782 - 8017 = 151
```

Rem 9.

```
18790 - 7B0100000000009C = 280
18798 - 0101CA4301019B01 = 429
18806 - 000000000 09C0101 = 158
18814 - DE4301029C010000 = 449
18822 - 0000009C0101F243 = 467
18830 - 01039D0100000000 = 162
18838 - 009C010106440104 = 237
18846 - 6202030000000121 = 137
18854 - 6649118443013800 = 448
18862 - EDB0110242EDA0ED = 1132
18870 - A0EDA013EDA011FC = 1242
18878 - 45EDA0116147EDA0 = 1048
18886 - 118E48EDA0CDD445 = 1114
18894 - C9646464196464 50 = 806
18902 - 1964645014484846 = 545
18910 - 14321E32141E3232 = 300
18918 - 0F0A0A280A0A0A28 = 145
18926 - 05013AEF49322448 = 534
18934 - 2165454723231 0FC = 612
18942 - 477E320249115648 = 497
18950 - 21CB492323232310 = 465
18958 - FAEDA0EDA03E0012 = 1124
18966 - 11A948EDA07E2142 = 880
18974 - 4977214E497 7C9 = 696
```

Rem 10.

```
18987 - CDA84521EF497EFE = 1167
18995 - 08280134CDF541CD = 821
19003 - F049CDA549C3E748 = 1254
19011 - CDCA413E0132EF49 = 897
19019 - 21FE473603233600 = 504
19027 - CDF049CDA549C3E7 = 1387
19035 - 482A0C40110A0019 = 242
19043 - EB2A0C4001030009 = 366
19051 - 1ABE38072801C923 = 556
19059 - 1318F52A0C401103 = 426
19067 - 001911E041010600 = 338
19075 - EDB0C92184430604 = 856
19083 - E55E235623232323 = 584
19091 - 7E2A0C401977E111 = 630
19099 - 0E001910EB2A0C40 = 408
19107 - 117B0119369C1120 = 425
19115 - 0019060336 9C2310 = 295
19123 - FB11C40019363421 = 628
19131 - 02425E23562A0C40 = 401
19139 - 193600CDA549C9CD = 926
19147 - FD453AFC45FE01C8 = 1156
19155 - CDBE44C93E01CDC2 = 1126
19163 - 4521FE4735281A46 = 616
19171 - 2A0C40111E00192B = 233
19179 - 10FD2B3680CDF049 = 1012
19187 - CD1345CD864AC3E7 = 1132
19195 - 482A0C40115E0219 = 328
19203 - CD4E412C26322A00 = 522
19211 - 343B2A37FFCD5C4A = 834
19219 - 3E02CDC245C3434A = 868
```

SERVICING YOUR ZX PRINTER

Is your printer noisy? Is the print quality not all that it should be? Kathleen Peel takes you through some simple servicing techniques stage by stage to make your printer as good as new.

THE ZX PRINTER is a very simple design which should provide years of service if it is properly maintained. Under no circumstances should servicing of a ZX printer take place if it is still under warranty, any faults should be repaired by Sinclair under guarantee.

The symptoms of a printer in need of maintenance are:

Excessive noise shown as drive screeching, and loss of print synchronisation displayed as badly formed characters.

There are two further problems with the quality of print output from the ZX printer which apply to new printers as well as old:

■The non-uniformity of print, shown as light and dark bands of printing, caused by irregularities in the metalisation of the paper. If it is very bad, there will always be the odd patch here and there, return the roll for replacement.

Roller deforms the paper

■The paper transport mechanism does not always feed the paper through after prolonged periods of inactivity. The roller deforms the paper and cannot grip sufficiently to overcome the initial paper roll turning torque.

Changing the ridiculous hubs to a solid bar will, to a large extent, remove this problem. A cheap improvement may be obtained by taking the hubs and pushing a biro outer case 4¾" — 97mm — long into them. It is essential for the fit to be tight otherwise it will not work, and be careful not to damage the hubs.

This modification — figure 1 — provides effectively one long continuous holder which will provide paper feed in most, if not all, conditions.

The only problem incurred by the above procedure is encountered when separating the hub from the biro case in order to install a new roll of paper, it is necessary to prise the hub and biro casing apart. If you find paper feed a problem then it may well be worth the trouble.

Noise from plain gears

The noise is generated by the plain gears which drive the optical reader and the helical gears which provide the paper feed through two worm wheel drives.

Sinclair designs show very high quality innovative thinking in system design, but do tend to have a basic lack of technique in the more mundane engineering fields. There are several inexpensive ways of producing low noise drives and this design would have benifitted enormously if some way could have been found to incorporate such techniques.

The printer may be serviced in two stages, the first stage hopefully will remove the distortion of printed characters and the second stage, which is more complex, should reduce the noise level.

This service should only be attempted if you are reasonably dextrous with your hands and feel confident that you can cope with the very delicate task. Failure to take great care will inevitably result in an unserviceable printer.

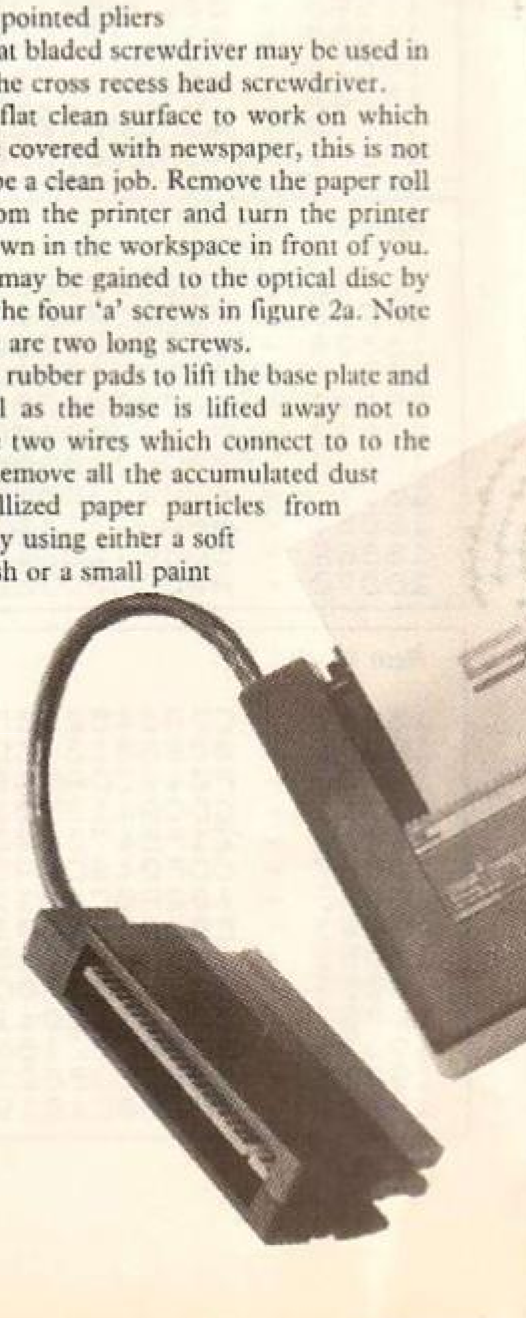
First obtain the following tools:
Fine paint brush
Small cross head screwdriver
And for stage two:
A pair of pointed pliers

A 1/8 flat bladed screwdriver may be used in place of the cross recess head screwdriver.

Find a flat clean surface to work on which should be covered with newspaper, this is not going to be a clean job. Remove the paper roll carrier from the printer and turn the printer upside down in the workspace in front of you.

Access may be gained to the optical disc by undoing the four 'a' screws in figure 2a. Note that there are two long screws.

Use the rubber pads to lift the base plate and be careful as the base is lifted away not to strain the two wires which connect to to the reader. Remove all the accumulated dust and metallized paper particles from the cavity using either a soft toothbrush or a small paint brush.



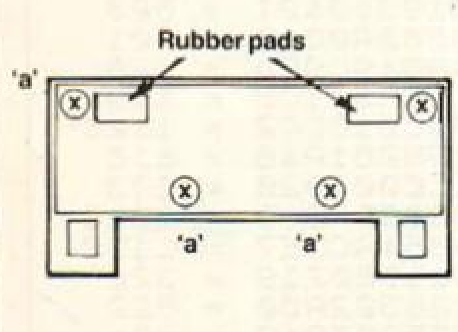


Figure 2a.

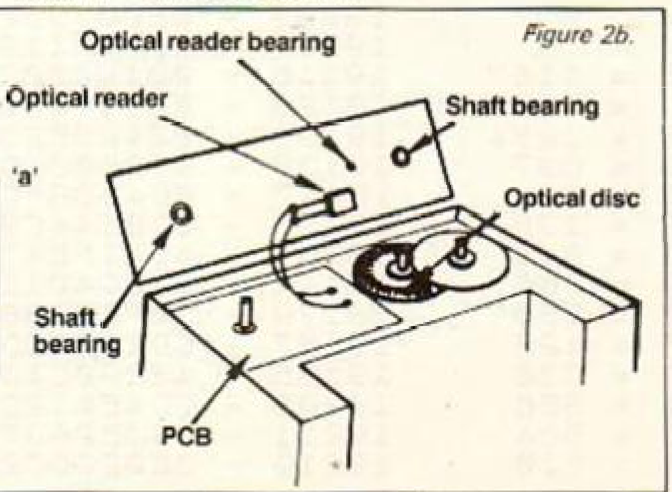
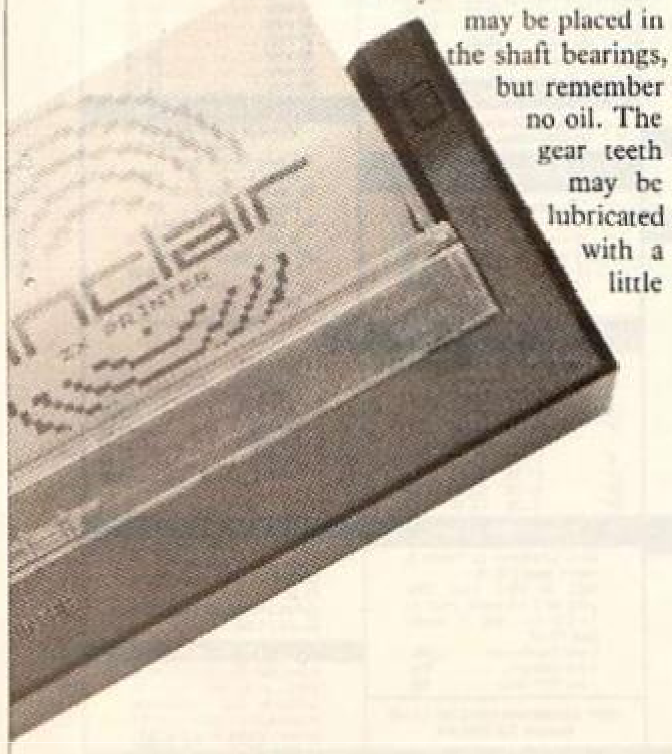


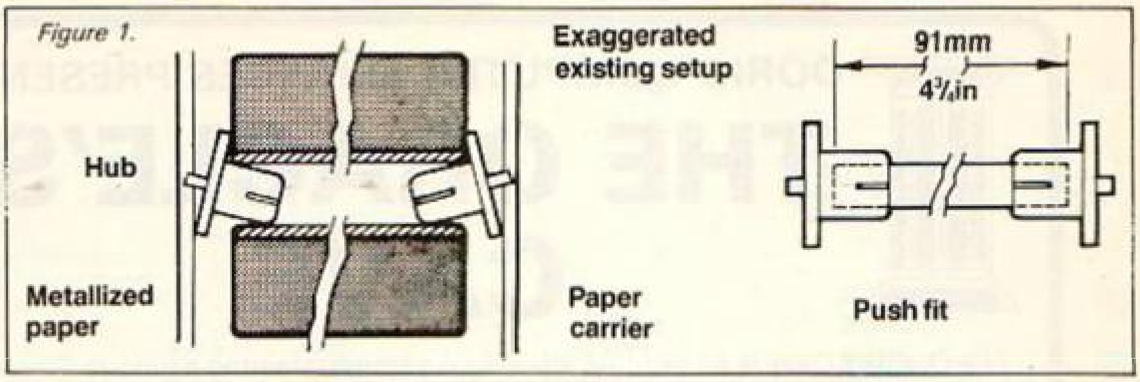
Figure 2b.

Exercise extreme care when cleaning the optical disc as damage here cannot be rectified. It is best to brush the accumulated dirt in a radial direction, from the cente outwards.

It is not advisable to oil the gears as besides giving the dust somewhere to stick, it can be spread onto the optical surface and cause future print distortion.

A very small dab of butter may be placed in the shaft bearings, but remember no oil. The gear teeth may be lubricated with a little





graphite, rub a 2B pencil lead lightly over the gear teeth, remove excess with the paint brush.

Replace the base plate taking care to ensure that all three shafts are correctly replaced in their respective bearings and then secure the plate in position with the two small screws in the middle.

If you have found the above task difficult then replace the two longer screws and do not go any further. Successful servicing should produce printer output that is correctly aligned.

Test the printer

The printer should now be tested to ensure that it is in fact functioning correctly. If the printer fails to operate, take the base off again and recheck that the reader wires have not been broken and that the optical disc is clean and undamaged.

Assuming that you wish to continue and that the printer still works, we can now attempt stage two.

Remove the paper carrier and turn the printer upside down. Remove the long 'b' screws shown in figure 3a and stand the printer back upright with the stylus aperture facing you.

Lift the top cover a ¼" — 6mm — away from the base, inside the stylus aperture gap will be the push fit connector shown in figure 3b. this has to be disconnected by pulling the connector with pliers away from the lug in the lid.

A flat small screwdriver may be used to lever the connector apart if in difficulty but do please exercise restraint and do not use excessive force.

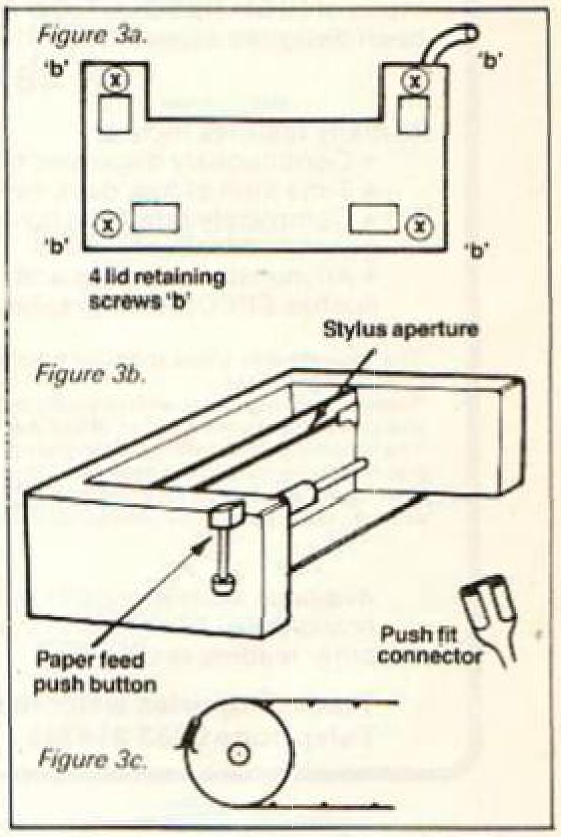
When the connection has been broken, I hope not literally, then take the top casing away. The whole of the printer mechanism should be in full view now so a few more words of warning before we continue.

The toothed rubber band carrying the stylii should not be dismantled; clean the band in place. The stylii are small and very loseable so keep a close watch on them, notice that the top of the stylus is shiny where it rubs the power return strip in the lid.

Use the brush to clean the inside of the lid and pay particular attention to the power return strip, clean thoroughly and make sure that there are no hairs left behind from the brush. Apply a very small dab of butter to the shaft bearings and put the lid safely to one side.

Take careful note of the way the paper feed switch is positioned, if you are going to make a mistake on reassembly it is likely to be this piece round the wrong way.

Carefully brush all the dirt away from each



component, take your time and do not hurry and remember that to remove most of the dirt is about all you can hope for, many parts are inaccessible.

I must admit that I have very lightly greased the gears in the upper compartment, but this is not strictly necessary and may speed up the time for the next service.

Carefully replace the push button lever, ensure the stylii are in a trailing position on the drive band spigot — figure 3c — and replace the cover to within ¼" — 6mm.

Now we have reached the last difficult task, to replace the pushfit connector. Widen the gap slightly and using the sharp nose pliers, push the two halves of the connector together using a lot of care and patience.

The lid must now be pushed forward to ensure clearance of the mica paper cover on the right hand side of the stylus aperture. Replace the plug cable lead into its slot, it will probably have fallen out by now, and looking down over the top of the lid use a pencil point to manoeuvre the paper feed button into alignment with its location hole in the lid.

The two halves of the assembly can now be eased together, again we are at a delicate stage, do not force it, if there is an obstruction simply pull apart by a ¼" and restart the final assembly procedure.

The four long screws can now be replaced, do not overtighten, and the unit tested. Once a technique has been developed for servicing the printer it becomes quite easy, but it still needs care if the printer is not to be permanently damaged. ■

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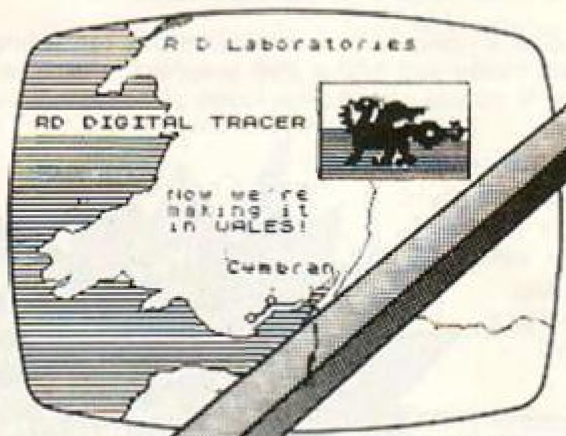

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MEMOTECH MEMORY

David Miles takes an objective look at the MTX-500.

Table 1.	0	2000	4000	8000	C000	FFFF
Page 0	8K Monitor ROM on all pages	Front panel ROM (8K)	512 RAM only	500/512 RAM	500/512 RAM on all pages	
Page 1		Basic ROM (8K)		512 RAM only		

Table 2.			
06 00	0A 00	80	FF
Length of line	Line number	Token for Rem	End marker

I HAVE HAD MY MTX-500 since late November and I have found it to be an exceptional machine, second only to the BBC.

The ROM is well-structured — unlike the messy layout of the Spectrum ROM — and this gives it the advantage of speed. However, there are bad features with every machine; the worst feature of the Memotech being the inadequate error messages. The cassette routines are also poor — in ROM between hex addresses 2AEE and 2B2F on page 1 — consisting of simple Load, Save and Verify routines with no provision made for Saving machine code, arrays, etc. The Circle command produces an ellipse, like the Oric-1.

This is not a programming error, but in the MTX-series the pixels are stretched laterally, so if a circle is plotted by Sin and Cos — which incidentally are faster than the BBC's mathematical functions — it will still end up as an oval.

The memory of a MTX-series machine is available on 16 64K pages, though only pages 0 and 1 are used in the unexpanded computers — see table 1.

The disadvantage of paged ROM is that it is difficult to keep jumping from one page to the next. For example, you cannot disassemble the Basic ROM on page 1 from the front panel because this is using page 0. The method to apply is to Poke the ROM routines into free RAM on page 0, so that it is possible to study that memory area from the front panel. The 8K monitor ROM contains the vital functions needed to set up the system ready for programming as well as all the graphics routines.

By disassembling the system-C 8K Basic ROM, I have discovered that the MTX-series use a token entry routine like the Sinclair and Commodore machines. This means that each Basic command, string or function has a number in a token table from 128 to 255. As the character codes of the function keys are between 128 and 144, they generate the first 16 tokens, eg., F1 is key 128 and Rem is token 128. By typing F1 and pressing Return, the word Rem is interpreted.

Print out Basic commands

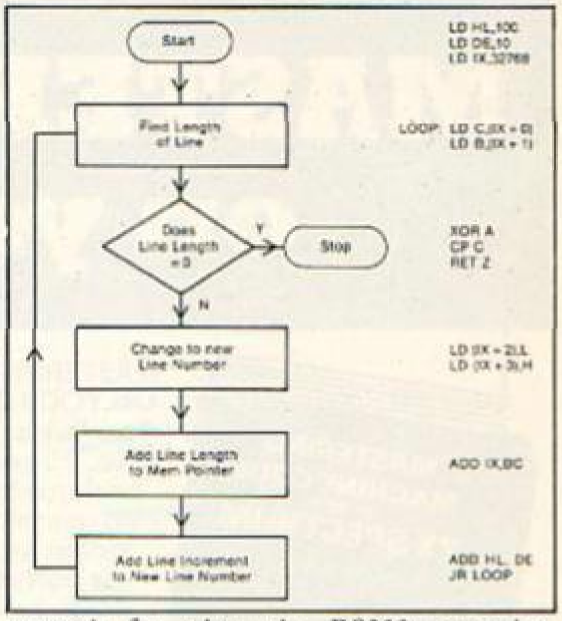
The program will print out the Basic commands, character codes and jump addresses by Peeking the token table:

```
10 REM * TOKEN TABLE PEEKER *
20 LET TJUMP=9975:LET CHAR=127
30 FOR A=9531 TO 9974
40 LET Z$=CHAR$(PEEK(A))
50 IF ASC(Z$)>127 THEN LET
   Z$=CHAR$(ASC(Z$)-128)+
   CHR$(9)
60 IF ASC(Z$)<32 THEN LET Z$=
   CHR$(9)
70 PRINT Z$;
80 IF RIGHT$(Z$,1)=CHR$(9) THEN
   GOSUB 100
90 NEXT A
100 LET M=PEEK(TJUMP):LET
   N=PEEK(TJUMP+1)
110 LET ADDRESS=N*256+M
120 LET CHAR=CHAR+1:LET
   TJUMP=TJUMP+2
130 IF CHAR,193 THEN LET
   ADDRESS=0
140 PRINT CHAR, ADDRESS
150 RETURN
```

The first thing you will probably notice is that there are six commands in the token table that are not mentioned in the manual. They are:

USER, NODE, FK, OFF, INP, FRE

Inp is the equivalent of the Spectrum's In command. It reads a byte from a port, for instance Print Inp(6) reads the keyboard matrix. Print Fre(X) returns free memory in the RML research machines but in the MTX-series it outputs e to the power of x. e is a constant (2.7128) used as the base for natural logs and in calculus. User jumps to a user routine at address 64137 — named User in the system variables. Node is associated with the



network for when the RS232 expansion becomes available.

The screen VRAM cannot be directly assessed. It is addressed by passing bytes through I/O ports 1 and 2. The necessary technical information is at the back of the manual, but try this routine:

```
10 PRINT " ";
20 FOR A=1 TO 13
30 READ B
40 OUT (1),B
50 NEXT A
60 DATA 72,105,32,77,84,88,32,85,
   115,101,114,115,33
```

A program is stored in the MTX-500 from hex address 8000 (decimal 32768). If you type the line:

10 REM

and then study the area 8000 hex through the Front Panel, you will see the bytes in table 2.

As line numbers are held in memory as two bytes, lines may be numbered as anything between 0 and 65535. This memory layout makes program renumbering a simple affair.

The procedure for entering an assembly language program is given on page 129 of the manual.

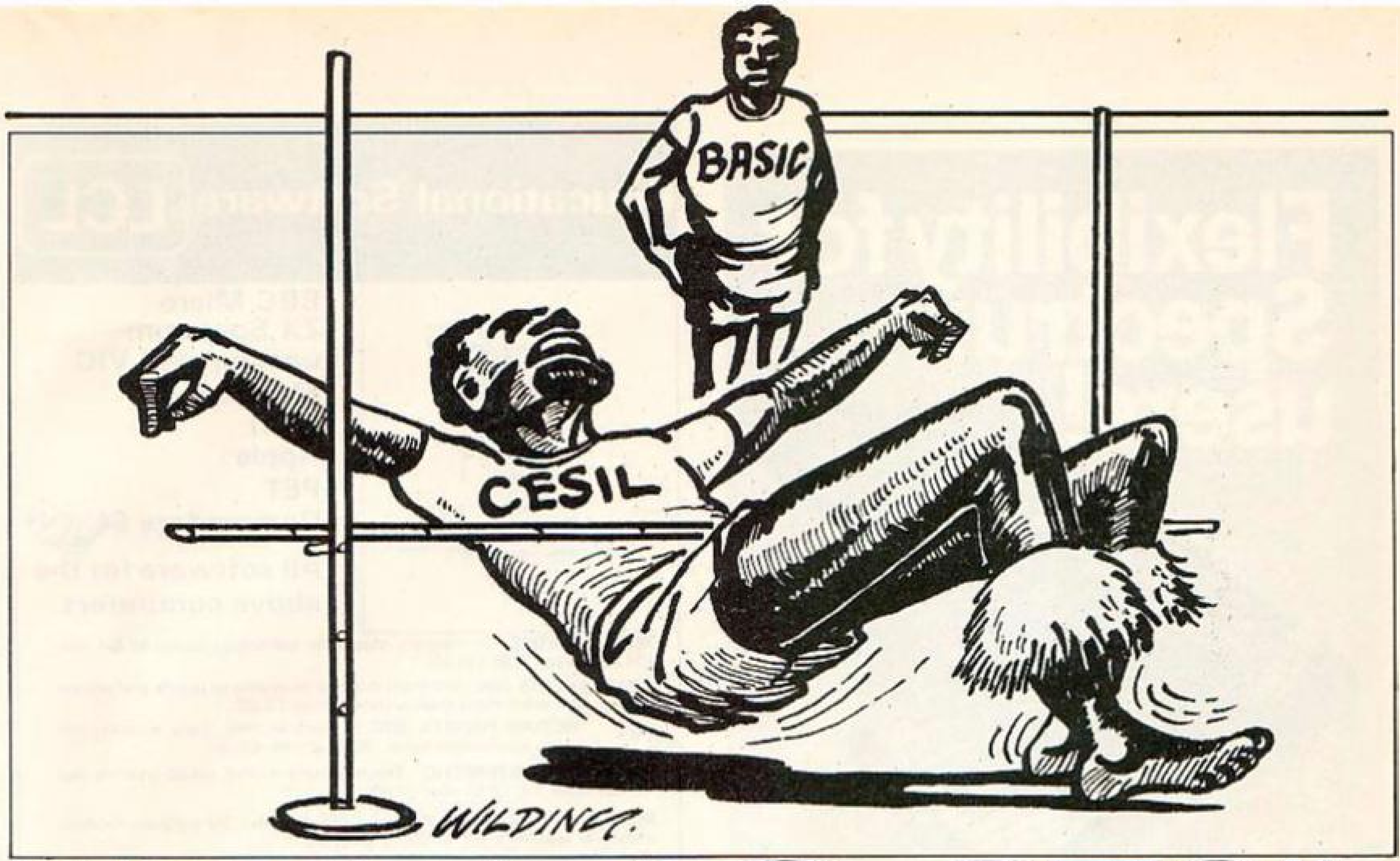
The two Reset keys, when pressed together, are supposed to erase the memory contents so that the computer can accept another program. In fact, the program remains in memory and is just over-written — as an examination of the memory at address 8000 hex will reveal. This means that previously unstoppable programs such as Toado or Kilopede can now be broken into and listed. Load in the program, press the two Reset keys and Poke 64167,1. This Poke makes the computer "remember" that it has a program in memory. The program is now listable.

This final routine will print the amount of memory left in bytes. It should be assembled into the first program line and called by

PRINT USR(32768)

The registers used are BC — top of Basic — and HL — start of system variables.

```
LD BC, (64167)
LD HL, 64082
SBC HL, BC
PUSH HL
POP BC
RET
```



Kevin Lawrence and a Vic-20 give a helping hand with an introduction to low level programming.

VIC-CESIL

CESIL IS AN ACRONYM for Computer Education in Schools Instruction Language, and is extensively used throughout Britain as an introduction to low-level programming. However despite their popularity, quality CESIL interpreters or compilers are normally only found on mini or mainframe computers — that is until now, as my CESIL will run on a Vic-20 and 8K RAM.

The text editor operates like a window over a long sheet of paper, as the program memory is 200 lines by 16 columns wide, of which 16 by 16 can be seen at any given time. The interpreter allows all standard commands including abbreviated versions of Subtract, Divide and Multiply.

Both the editor and interpreter can be used with the new Commodore 1520 colour printer to produce listings and sample runs. But more about the programs features later on, first the difficult bit, getting it working.

First, type in the program shown in figure 1. This is a simple monitor type program with four functions — Enter code, Check code and, for those who want to spread the typing over a length of time, Save and Load.

When you select the Enter option you will be asked for a start address this will be one of the four or five digit decimal numbers from the listing in figure 2. You can then proceed to type in the hexadecimal numbers following it. When you get to the next decimal number you can either type B to choose another start address or m to get back to the original menu.

If at the menu stage you press F7 for the Check routine you will again be asked for a start address but this time when you have typed that in your Vic-20 will print out the contents of that location, if the contents are correct then press Y and the computer will move on to the next location.

If they are, however, incorrect press N and you will then be given the opportunity to type in what it should be. As with the Enter routine you have the option to return to the menu or the start address stage, this is done by pressing the same keys, M and B.

When you finish a session of entering code, remember to Save it or it will all be lost when you turn the machine off.

Once all the code is entered and Saved you can think about testing it, to do this you must type in the listing in figure 3 and then Save it on the tape that you want the finished version to be on, this is the loader program.

Then load the monitor program followed by the machine code, then use the Save option to record the code on the same tape as the loader program and directly after it. If everything is OK you should then have a CESIL interpreter just waiting to be Loaded and Run.

The text editor allows easy creation of CESIL programs. The cursor keys are used to

(continued on page 103)

Figure 4.

```
0 REM "s"=SHIFT/CLR
1 REM "Q"=CRSR DOWN
2 REM "R"=RVS ON
3 REM "L"=RVS OFF
4 REM "E"=F1
5 REM "h"=F7
6 REM "a"=F5
7 REM "i"=F3
8 REM "E"=CTRL/2
9 REM
10 POKE36879,8:PRINT"sE"
12 POKE56,31:POKE55,255:POKE51,255:POKE5
2,31
100 PRINT"Q          MONITOR.
110 PRINT"Q             BY"
120 PRINT"Q        K.LAWRENCE"
130 PRINT"QQQRF1L        ENTER PROGRAM"
132 PRINT"QRF3L        LOAD PROGRAM"
134 PRINT"QRF5L        SAVE PROGRAM"
140 PRINT"QRF7L       CHECK PROGRAM"
150 POKE198,0
160 GETA$
170 IFA$="E"THEN2000
180 IFA$="h"THEN3000
190 IFA$="a"THEN4000
200 IFA$="i"THEN5000
210 GOTO160
900 H$="0123456789ABCDEF"
910 P1=INT(P/16):N$=MID$(H$,P1+1,1)
920 P2=P-P1*16:N$=N$+MID$(H$,P2+1,1):RET
URN
1000 D=0
1010 FORI=1TOLEN(H$)
1020 A=ASC(MID$(H$,I,1))-48
1030 D=D*16+A+(A>9)*7:NEXT
1040 RETURN
2000 INPUT"sSTART ADDRESS";AD
2010 PRINT"QQ"
2020 INPUTH$:IFH$="B"THEN2000
2030 IFH$="M"THENPRINT"s":GOTO100
2035 IFLEN(H$)<>2THENPRINT"ERROR":GOTO20
20
2036 GOSUB1000
2040 POKEAD,D:AD=AD+1
2050 GOTO2020
3000 INPUT"sSTART ADDRESS";AD
3005 PRINT"QQ"
3010 P=PEEK(AD):GOSUB900
3020 PRINT"Q";N$
3030 POKE198,0
3040 GETA$:IFA$=""THEN3040
3050 IFA$="N"THEN3100
3060 IFA$="Y"THEN3130
3070 IFA$="B"THEN3000
3080 IFA$="M"THENPRINT"s":GOTO100
3090 GOTO3040
3100 INPUT"QWHAT SHOULD IT BE";H$
3110 IFLEN(H$)<>2THENPRINT"ERROR":GOTO31
00
3120 GOSUB1000:POKEAD,D
3130 AD=AD+1:GOTO3010
4000 DATAA9,20,A2,BD,FF,A9,01,A2,01,A0,F
F,20,BA,FF,A9,00,85,20,A9,20,85,01,A9,00
,A2,00
4010 DATAA0,40,20,D8,FF,60
4020 FORX=0TO31:READH$:GOSUB1000:POKE256
+X,D:NEXT
4030 SYS256:GOTO5010
4999 END
5000 LOAD"",1,1
5010 PRINT"s":GOTO100
```

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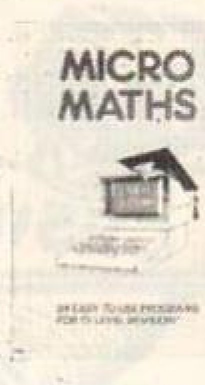

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(continued from page 101)

move around, and in addition to that, the editor has 13 "special" functions, these are shown in table 1. Some of the commands are protected, that is, the border will change colour and the Vic-20 will wait for further input; when this happens, you should press the space bar to carry out the command. Any other key returns you to the editor as if nothing had happened.

Sometimes the border will quickly flash red when you try to do something, this means that what you want done is not possible. An example of this is trying to insert a space when there is a character in the rightmost column of that line.

The best way to learn the commands is to actually use them and see what they do in practice.

When you see the interpreter prompt of ";" you can run the program currently in memory either to the screen — by using the R command — or to the printer — the P command.

Comments must be preceded with an asterisk and contain no spaces and cannot be placed in the middle of a statement.

Label definitions must be preceded by a colon.

Integers in the range +65535 to −65535 can be handled.

Acceptable commands are as follows:
IN, OUT, LOAD, STORE, ADD SUBTRACT, MULTIPLY, DIVIDE, JUMP, JINEG, LINE, PRINT, SUB, DIV, MULT AND HALT.

For an explanation of their uses you should refer to O'level programming books or the ICL Cesil Reference Card.

If you wish to return to the editor from the interpreter then you just type T and Return.

The following is a simple guide to Cesil commands. It does not show programming techniques, only the bare bones. It is up to you to create the body from the skeleton.

IN: When the interpreter meets the In command the cursor is turned on and waits for the user to type in a number, which goes into the accumulator.

LOAD: This command must be followed by either a number or a variable. The value is placed in the accumulator. For example:

LOAD 1

Table 1.

CTL

I	= Insert one space.
D	= Delete one character.
F	= Move to first page.
E	= Move to last page.
+	= Move onward four lines.
–	= Move backwards four lines
S	= Save file.
L	= Load file.
N	= New — delete file.
Q	= Delete one line.
M	= Insert one line.
C	= Enter the CESIL interpreter.
P	= obtain printout.

OUT: This displays the current contents of the accumulator.

PRINT: This command allows words to be outputted, the required literal must be enclosed in quotes. Variables cannot be displayed with this command, for example:

PRINT 'AVERAGE'

HALT: This tells Cesil to stop executing the program.

LINE: This simply moves the cursor down one line.

STORE: Puts the value of the accumulator into the stated variable, for example

STORE COUNT

JUMP: An unconditional branch, think of a Goto in Basic, for example

JUMP START

JIZERO: A conditional branch, meaning jump if the value of the accumulator is equal to 0, for example:

JIZERO END

JINEG: Another conditional, this time it means jump if the value of the accumulator is negative, for example:

JINEG HALT

Note that the name of a Cesil command can be used as a label, this is because labelled lines are immediately preceded by a colon in Viccesil.

For calculations you can use Add, Multiply, Subtract and Divide or Add, can be followed by either a value or a variable.

If you would like a copy of Viccesil but you do not wish to key it in, then send £3 inc. p+p. to Cesil Offer, 32 Highfield Cresent, Abergavenny, Gwent.

Figure 2.

```
 8192
A9 08 8D 0F 90 A2 00 BD 00 3E 9D 00 1A
9D 00 3F 9D 00 11 A9 05 9D 00 94 9D 00
95 E8 D0 E9 A9 20 8D FF 11 8D FE 11 8D
FC 11 A9 20 8D FD 11 20 00 29 20 C2 31
20 00 31 20 91 30 20 00 32 20 12 2C 4C
34 20 27 D0 EE AD FC 11 18 00 F5
CHECKSUM= 7151
 8272
02 09 0E 03 0F 15 14 04 0C 0F 01 04 05
13 14 0F 12 05 03 01 04 04 08 13 15 02
14 12 01 03 14 08 0D 15 0C 14 09 10 0C
19 06 04 09 16 09 04 05 04 0A 15 0D 10
06 0A 09 1A 05 12 0F 05 0A 09 0E 05 07
04 0C 09 0E 05 05 10 12 09 0E 14 03 13
15 02 04 0D 15 0C 14 03 04 09 16 04 08
01 0C 14 F5
CHECKSUM= 1293
 8368
A2 00 BD 50 20 9D 00 10 E8 E0 5A D0 F5
00 F5
CHECKSUM= 1880
 8448
A9 93 20 D2 FF A9 05 20 D2 FF A2 00 BD
C1 35 20 D2 FF E8 E0 3F D0 F5 A9 0D 20
D2 FF 20 D2 FF A9 3E 20 D2 FF 20 83 30
AD 3D 03 C9 54 D0 03 4C 00 20 C9 52 D0
03 4C 00 22 C9 50 D0 03 4C 24 24 A9 0D
4C 1C 21 F5
CHECKSUM= 8368
 8704
22 F0 37 EA A9 00 85 21 22 20 28 20 D2
34 A0 51 23 C9 3A D2 23 4C 08 22 C9 2A
F2 EC 22 98 37 E0 10 D0 03 4C 1C 24 E0
08 D0 00 A9 20 20 D2 FF 4C 08 22 E0 0C
D0 03 4C 35 38 E0 01 D0 03 4C 81 38 E0
02 D0 03 4C CE 37 E0 08 D0 03 4C D7 38
F0 0A D0 03 4C 5D 39 E0 09 D0 03 4C 6F
39 E0 03 D0 03 4C 39 3A E0 02 D0 03 4C
F9 3A E0 04 D0 03 4C 80 3B E0 05 D0 03
4C 95 3B E0 0D D0 03 4C 95 3B E0 06 D0
03 4C 00 3C F0 0E D0 03 4C 00 3C E0 07
D0 03 4C 40 3C E0 0F D0 03 4C 40 3C 00
F5
CHECKSUM= 15443
 8962
A9 01 85 02 85 21 A9 12 85 02 A2 01 A0
00 B1 01 C9 20 D0 1A C8 C0 12 D0 F5 E8
A5 01 18 69 10 85 01 A5 02 69 00 85 02
E2 C9 D0 E1 4C 33 23 86 62 4C 14 23 A9
02 20 BD FF A9 03 A2 06 A0 03 20 BA FF
20 C0 FF A2 03 20 C9 FF A9 31 20 D2 FF
A9 03 20 C3 FF A9 00 20 BD FF A9 04 A2
06 A0 00 20 BA FF 20 C0 FF A2 04 20 C9
FF A9 00 85 01 A9 12 85 02 A2 00 A0 00
B1 01 10 C9 20 10 03 18 69 42 20 D2 FF
C8 C0 10 D0 EC A9 0D 20 D2 FF E8 A5 01
18 69 10 85 01 A5 02 69 00 85 02 E4 62
D0 D5 20 E7 FF 4C 00 20 A9 00 20 BD FF
A9 07 A2 06 A0 07 20 BA FF 20 C0 FF 90
03 4C 00 20 20 E7 FF 4C 00 23 F5
CHECKSUM= 21345
 9216
A9 00 20 BD FF A9 04 A2 06 A0 00 20 BA
FF 20 C0 FF 90 03 4C 17 21 A2 04 20 C9
FF 4C 00 22 20 E7 FF 4C 17 21 A9 0D 20
D2 FF 4C 00 24 F5
CHECKSUM= 4835
 9372
FF FD
CHECKSUM= 508
 9472
A2 00 A9 20 9D 00 12 9D 00 13 9D 00 14
9D 00 15 9D 00 16 9D 00 17 9D 00 18 9D
00 19 9D 00 1A 9D 00 1B 9D 00 1C 9D 00
1D 9D 00 1E E8 D0 D6 4C 00 20 FD
CHECKSUM= 3731
 9753
20 FD
CHECKSUM= 285
 9775
20 20 20 20 FD
CHECKSUM= 381
 9788
20 20 20 FD
CHECKSUM= 349
 9835
8D FD
CHECKSUM= 442
 10240
20 00 2C 4C C2 31 A9 42 20 92 FF 20 CC
FF 20 E7 FF A2 00 A9 20 9D 00 12 9D 00
13 9D 00 14 9D 00 15 9D 00 16 9D 00 17
9D 00 18 9D 00 19 9D 00 1A 9D 00 1B 9D
00 1C 9D 00 1D 9D 00 1E 9D 00 1F E8 D0
D3 4C 00 20 F5
CHECKSUM= 5976
 10496
0D 4D 49 53 53 49 4E 47 20 4C 41 42 45
4C F5
CHECKSUM= 1180
 10752
A5 2F 85 01 A5 30 85 02 A2 00 BD 00 29
20 D2 FF E8 E0 0E D0 F5 4C D5 2E F5
CHECKSUM= 3086
 11008
20 00 2C 4C 00 30 A5 C5 C9 18 D0 03 4C
12 29 4C 00 36 A9 0D 20 D2 FF A2 00 BD
27 29 20 D2 FF E8 E0 0A D0 F5 4C D5 2E
55 53 45 52 20 42 52 45 41 4B A9 00 85
C6 4C 1E 24 F5
CHECKSUM= 5944
 11264
A2 00 BD AC 2F 9D 1A 10 A9 04 9D 1A 94
E8 E0 0E D0 F0 AD FC 11 85 02 20 00 2D
A2 00 BD 3D 03 18 69 30 9D 20 10 E8 E0
03 D0 F2 AD FC 11 18 69 0F 85 02 20 00
2D A2 00 BD 3D 03 18 69 30 9D 25 10 E8
E0 03 D0 F2 60 FD F2 60 FD
CHECKSUM= 8192
 11388
DD FD
CHECKSUM= 474
 11520
A9 03 8D 3C 03 A2 00 A0 00 A5 62 38 FD
8E 35 85 63 B0 07 98 9D 30 03 4C 22 2D
A5 63 85 62 C8 4C 09 2D E8 E0 03 D0 E2
52 20 00 2D A2 02 BD 30 03 18 69 30 22
D2 FF E8 E0 03 D0 F2 4C 31 28 A5 21 85
62 4C 28 2D FD
CHECKSUM= 7322
 11776
A9 0D 20 D2 FF A2 00 BD 00 2F 20 D2 FF
E8 E0 10 D0 F5 4C D5 2E 4C 17 21 A9 0D
20 D2 FF A2 00 BD 10 2F 20 D2 FF E8 E0
1C D0 F5 4C D5 2F A9 0D 20 D2 FF A2 00
BD 2C 2F 20 D2 FF E8 E0 09 D0 F5 4C D5
2E A9 0D 20 D2 FF A2 00 BD 35 2F 20 D2
FF E8 E0 0C D0 F5 4C 1E 24 A9 0D 20 D2
FF A2 00 BD 41 2F 20 D2 FF E8 E0 0F D0
F5 4C D5 2E A9 0D 20 D2 FF A2 00 BD 50
2F 20 D2 FF E8 E0 11 D0 F5 4C D5 2E A9
0D 20 D2 FF A2 00 BD 61 2F 20 D2 FF E8
E0 0A D0 F5 4C D5 2E A9 0D 20 D2 FF A2
00 BD 6B 2F 20 D2 FF E8 E0 12 D0 F5 4C
D5 2E A9 0D 20 D2 FF A2 00 BD 7D 2F 20
D2 FF E8 E0 10 D0 F5 4C D5 2E A9 0D 20
D2 FF A2 00 BD 8D 2F 20 D2 FF E8 E0 10
D0 F5 4C D5 2E A2 00 BD 9D 2F 20 D2 FF
E8 E0 0F D0 F5 A5 02 38 E9 12 85 02 A2
00 46 01 46 02 90 00 A9 00 85 01 85 01
E8 E0 04 D0 EF 4C 3E 2D 82 4E 55 4D 42
45 52 20 54 4F 4F 20 4C 41 52 47 45 49
4C 4C 45 47 41 4C 20 43 48 41 52 2E 20
49 4E 20 20 20 20 20 20 4E 55 4D 42 45
52 42 41 44 20 49 4E 58 55 54 48 41 4C
54 20 4D 49 53 53 49 4E 47 53 54 52 49
4E 47 20 54 4F 4F 20 4C 4F 4E 47 4E 4F
4E 53 45 4E 53 45 20 49 4E 20 43 45 53
49 4C 4E 4F 20 4C 49 54 45 52 41 4C 54
4F 4F 20 43 41 4E 59 20 56 41 52 49 41
42 4C 45 53 4E 4F 20 53 55 43 48 20 56
41 52 49 41 42 4C 45 44 49 56 49 53 49
4F 4E 20 42 59 20 5A 45 52 4F 0D 45 52
52 4F 52 20 49 4F 20 4C 49 4F 45 20 0C
29 0E 25 13 22 30 30 30 2D 2D 30 31 35
4C 45 45 FD
CHECKSUM= 46424
 12288
AE FC 11 A9 12 85 2C A9 00 85 2B E0 00
F0 10 A5 2B 18 69 10 85 2B A5 2C 69 00
85 2C CA D0 F0 A9 10 85 01 A9 45 85 02
A2 00 A0 00 B1 2D 91 00 A5 00 85 2D A5
01 18 69 04 85 2E A9 01 91 2D C8 C0 10
```

(Figure 2 continued on page 104)

(Figure 2 continued from page 103)

```
D0 E8 E8 18 A5 2B 69 10 85 2B A5 2C 69
00 85 2C A5 00 18 69 16 85 00 A5 01 69
00 85 01 E0 10 D0 C7 60 AE FF 11 A9 10
85 2C A9 45 85 2B E0 00 F0 0E A5 2B 18
69 16 85 2B A5 2C 69 00 85 2C CA D0 F0
AD FE 11 18 65 2B 85 2B A5 2C 69 00 85
2C 60 20 63 30 A0 00 AD FD 11 18 69 80
91 2B 60 EE FE 11 AD FE 11 C9 10 D0 03
EE FF 11 60 CE FE 11 AD FE 11 C9 FF D0
03 CE FF 11 60 F5
CHECKSUM= 20153
 12538
20 8B 31 4C 91 30 AD 8D 02 C9 04 D0 03
4C 3B 32 20 F4 FF EA EA C9 0D F0 39 C9
11 F0 47 C9 1D F0 4D C9 91 F0 5A C9 9D
F0 5F C9 20 10 01 60 C9 60 30 01 60 38
E9 40 B0 02 69 40 8D FD 11 4C 68 31 F0
3D C9 9D F0 42 60 20 63 30 A0 00 AD FD
11 91 2B 60 20 41 31 A9 00 8D FE 11 EE
FF 11 20 8B 31 20 CD 31 60 20 41 31 EE
FF 11 4C 57 31 60 20 41 31 20 9F 30 AD
FE 11 29 0F 8D FE 11 4C 57 31 20 41 31
CE FF 11 4C 57 31 20 41 31 20 AD 30 4C
6E 31 A9 60 8D 29 30 20 00 30 A9 A0 8D
29 30 A0 00 B1 00 91 2B C8 C0 10 D0 F7
E8 18 A5 2B 69 10 85 2B A5 2C 69 00 85
2C A5 00 18 69 16 85 00 A5 01 69 00 85
01 E0 10 D0 D6 20 63 30 A0 00 B1 2B 8D
FD 11 60 AD FF 11 C9 10 F0 05 C9 FF F0
11 60 CE FF 11 AD FC 11 C9 B8 F0 11 EE
FC 11 4C F4 31 EE FF 11 AD FC 11 F0 03
CE FC 11 20 00 30 4C C2 31 F5
CHECKSUM= 28206
 12800
A9 20 8D 43 10 8D 56 10 8D 8D 11 8D A0
11 AD FC 11 C9 00 D0 11 A9 2A 8D 43 10
8D 56 10 A9 02 8D 43 94 8D 56 94 60 C9
08 D0 F8 A9 2A 8D 8D 11 8D A0 11 A9 02
8D 8D 95 8D A0 95 60 A5 C5 C9 0C D0 03
4C 00 33 C9 12 D0 03 4C 43 33 C9 2A D0
03 4C 77 33 C9 31 D0 03 4C 82 33 C9 05
D0 03 4C 13 34 C9 3D D0 03 4C 2C 34 C9
29 D0 03 4C 35 35 C9 15 D0 03 4C 4C 35
C9 1C D0 03 4C BA 33 C9 30 D0 03 4C 00
36 C9 24 D0 03 4C 67 37 C9 22 D0 03 4C
00 38 C9 0D D0 03 4C A4 23 60 F5
CHECKSUM= 15730
 13056
20 41 31 A9 60 8D 85 30 20 63 30 A9 18
8D 85 30 A0 0F B1 2B C9 20 F0 03 4C 00
34 EE FE 11 88 B1 2B AA A9 20 91 2B C8
8A 91 2B 88 CC FE 11 10 EE CE FE 11 20
FA 30 A2 00 A0 A0 C8 D0 FD E8 E0 60 D0
F8 60 20 41 31 A9 60 8D 85 30 20 63 30
A9 18 8D 85 30 AD FF 11 D0 03 4C 00 34
A0 00 C8 B1 2B AA A9 20 91 2B 88 8A 91
2B C8 C0 0F D0 EF 20 33 33 4C 82 31 4C
82 31 A9 00 8D FC 11 20 00 30 4C 33 33
A9 B8 8D FC 11 20 00 30 4C 33 33 AD FC
11 C9 B8 10 0C AD FC 11 18 69 04 8D FC
11 20 B4 33 4C 33 33 AD FC 11 F0 58 38
E9 04 8D FC 11 20 B4 33 4C 33 33 20 41
31 4C 00 30 A9 00 8D 0F 92 20 E4 FF F0
FB A0 08 8C 0F 90 C9 20 F0 01 60 A2 00
A9 20 9D 00 12 9D 00 13 9D 00 14 9D 00
15 9D 00 16 9D 00 17 9D 00 18 9D 00 19
9D 00 1A 9D 00 1B 9D 00 1C 9D 00 1D 9D
00 1E 9D 00 1F 4C A0 35 F5 A9 0A 8D 0F
90 20 36 33 A9 00 8D 0F 90 60 43 45 53
49 4C AD FC 11 C9 05 10 03 4C 94 33 C9
B9 30 03 4C 94 33 A9 B4 8D FC 11 4C 94
33 AD FC 11 C9 0A 10 03 4C A0 33 C9 04
30 03 4C A0 33 A9 04 8D FC 11 4C A0 33
A9 05 8D 3C 03 A2 00 A0 00 A5 2B 38 FD
8C 35 85 2D A5 2C FD 87 35 85 2E B0 07
98 9D 3D 03 4C 72 34 A5 2D 85 2B A5 2C
85 2C C8 4C 4F 34 F0 C0 05 D0 D5 A5 2A
8D 42 03 60 A9 00 85 2B 85 2C AE 3C 03
F0 27 A0 05 86 00 BD 3C 03 AA F0 17 A5
2B 18 79 0D 35 85 2B A5 2C 79 8D 35 85
2C 90 03 4C 00 2E CA D0 E9 A6 00 88 CA
D0 DB AD 42 03 85 2A 60 AE 3C 03 BD 3C
03 C9 30 30 10 C9 3A 10 0C 38 E9 30 9D
3C 03 CA F0 00 D0 EA 60 4C 18 2E A2 00
A2 00 B1 01 C9 20 F0 18 9D 51 03 E8 A5
01 18 69 01 85 01 A5 02 69 00 85 02 20
C8 36 E0 00 D0 E2 4C 57 2E 8E 50 03 60
FD
CHECKSUM= 51480
 13568
A9 93 20 68 35 18 A0 00 A2 01 EA EA EA
A2 00 20 CF FF C9 0D F0 07 9D 00 2F E8
4C 0F 35 86 02 20 7C 35 A9 20 A2 01 A0
FF 20 BA FF A5 02 A2 0A A0 2F 20 BD FF
60 20 00 35 A9 12 85 01 A9 00 85 00 A9
00 A2 FF A0 1F 20 D8 FF 4C 82 35 20 00
35 A9 0D 20 D2 FF A9 00 A2 FF A0 FF 20
D5 FF 4C 82 35 40 49 4C 45 20 4E 41 4D
45 3A 20 20 D2 FF A2 00 BD 60 35 20 D2
FF E8 E0 03 D0 F5 60 A9 00 20 D2 FF 60
A2 00 BD 3E 9D 00 10 BD 03 3F 9D 00
11 A9 05 9D 00 94 9D 00 95 E8 D0 E9 A9
00 8D FC 11 20 00 30 4C 00 28 F0 F0 03
4C D2 33 A9 00 8D FC 11 20 00 30 4C C2
31 27 03 00 00 00 10 C8 64 0A 01 20 2A
2A 2A 2A 20 56 49 43 20 43 45 53 49 4C
2E 20 2A 2A 2A 20 20 20 20 20 20 20 20
A3 A3 A3 A3 A3 A3 A3 A3 A3 A3 20 20 20
20 20 20 20 20 20 4B 4D 4C 20 56 31 2E
31 20 28 43 29 31 39 38 33 A9 0F 8D 0F
90 22 E4 FF F0 FB A0 00 8C 0F 90 C9 20
F0 01 60 A9 60 8D 1F 30 AD FC 11 85 FF
18 6D FF 11 AA E0 C7 D0 03 4C 67 36 E8
8E FC 11 20 60 36 A5 2B 85 00 A5 2C 85
01 CA 8E FC 11 20 60 36 A0 00 B1 00 91
2B C8 C0 10 D0 F7 E8 E0 C7 D0 DA A9 A9
8D 1F 30 A5 FF 8D FC 11 20 0F 36 4C C2
31 20 00 30 AE FC 11 60 A9 A9 8D 1F 30
4C 00 34 A2 00 A9 20 9D 70 1E E8 E0 10
D0 F8 4C 00 30 A2 00 A9 20 8D 42 03 20
CF FF C9 2D D0 06 8D 42 03 4C 9A 36 C9
2B F0 04 9D 3D 03 E8 20 CF FF C9 0D F0
07 9D 3D 03 E8 4C 9A 36 E0 07 30 03 4C
2D 2E 8E 3C 03 60 A9 AF 8D AD 36 A9 36
8D AE 36 20 7E 36 A9 2D 8D AD 36 A9 2F
8D AE 36 60 A5 2C A5 02 C9 1E D0 09 A5
01 C9 80 30 03 4C 42 2E 60 20 CD 36 A0
00 B1 01 C9 20 D0 10 A5 01 18 69 01 85
01 A5 02 69 00 85 02 4C DD 36 60 FD
CHECKSUM= 52293
 14080
A9 60 8D 1F 30 AD FC 11 85 6A 18 6D FF
11 85 FF C9 C7 D0 03 4C 00 34 A2 C7 CA
8E FC 11 20 00 37 A5 2B 85 00 A5 2C 85
01 E8 8E FC 11 20 00 37 A0 00 B1 00 91
2B C8 C0 10 D0 F7 CA E4 FF D0 DA 8E FC
11 20 00 30 A0 00 A9 20 91 2B C8 C0 10
D0 F9 A9 A9 8D 1F 30 A5 6A 8D FC 11 20
00 30 4C C2 31 20 00 30 AE FC 11 60 A9
60 8D 1F 30 AD FC 11 85 6A A9 C7 8D FC
11 20 00 30 A5 6A 8D FC 11 A0 00 A2 00
B1 2B C9 20 D0 08 C8 C0 10 D0 F5 4C 00
37 A9 A9 8D 1F 30 4C 00 34 A9 50 85 2F
A9 20 85 30 A2 00 A0 00 B1 2F CD 50 03
D0 0E C8 B1 2F D9 50 03 D0 05 CC 50 03
D0 F3 60 A0 00 B1 2F 85 00 A5 2F 38 65
00 85 2F E8 E0 11 D0 D7 4C 6C 2E A9 0D
20 D2 FF 20 7E 36 20 B5 34 20 7D 34 A9
0D 20 D2 FF A5 2B D0 08 A5 2C D0 04 A9
2B 85 2A 4C 08 22 A2 00 8A 9D 00 1F E8
D0 FA A9 12 85 02 86 6A 60 A9 0D A9 00
85 2B 85 2C A9 2B 85 2A 4C 00 21 C9 20
F0 01 60 A9 00 85 2B A9 00 85 2C A9 2B
85 2A 4C 00 21 05 A2 0E A0 34 20 BD FF
A9 00 A2 FF A0 FF 20 D5 FF 68 68 4C 00
20 20 DD 36 EA EA EA C9 22 F0 03 4C 81
2E A5 01 18 69 01 85 01 A5 02 69 00 85
02 20 C8 36 A1 01 C9 22 F0 0D C9 20 10
03 18 09 40 20 D2 FF 4C 46 38 A9 0D 20
D2 FF A5 01 18 69 01 85 01 A5 02 69 00
85 02 20 CB 36 4C 08 22 20 45 34 A2 00
A0 00 BD 3D 03 C9 00 D0 0A E8 E0 05 D0
F4 A9 20 8D 42 03 AD 42 03 C9 2B D0 05
A9 20 8D 42 03 AD 42 03 20 D2 FF A2 00
A0 00 BD 3D 03 C9 00 D0 04 C0 00 F0 07
18 69 30 20 D2 FF C8 E8 E0 05 D0 E9 C0
00 D0 05 A9 30 20 D2 FF A9 0D 20 D2 FF
4C 08 22 20 DD 36 20 D2 34 A2 00 BD 50
03 9D 60 03 E8 F0 10 FA DA F4 20 00 39
4C 08 22 F5
CHECKSUM= 53041
 14592
A5 01 85 2F A5 02 85 30 A9 00 85 01 A9
12 85 02 A0 00 A1 01 C9 20 D0 1A A5 01
18 69 01 85 01 A5 02 69 00 85 02 C9 1E
D0 E9 A5 01 C9 80 30 F3 4C 00 2A C9 3A
D0 E2 A5 01 85 31 A5 02 85 32 20 D2 34
CE 50 03 A2 00 BD 52 03 DD 61 03 D0 CA
E8 EC 60 03 D0 F2 A5 31 85 01 A5 32 85
02 60 A5 2A C9 2D D0 03 4C D7 38 20 DD
36 20 D2 34 4C 08 22 A5 2B D0 07 A5 2C
D0 03 4C D7 38 4C D0 39 A2 00 BD 00 1F
D0 08 E8 F0 18 D0 F6 4C 00 3A BA 86 00
A2 03 0A 0A 0A A8 B9 18 1F C9 00 F0 0E
9D 61 03 E8 C8 4C 95 39 8E 60 03 A6 00
AD 60 03 CD 50 03 D0 D3 A2 00 BD 61 03
DD 51 03 D0 20 E8 EC 50 03 D0 F2 A6 00
8A 0A AA A5 2B 9D 80 1E E8 A5 2C 9D 80
1F A6 00 A5 2A 9D D0 1E 4C 08 22 A6 00
4C 84 39 F5
CHECKSUM= 23294
 14848
A2 00 BD 00 1F F0 08 E8 E0 18 D0 F6 4C
96 2F A9 01 86 00 9D 00 1F AD 50 03 C9
00 30 05 A9 07 8D 50 03 A0 00 8A 0A 0A
0A AA B9 51 03 9D 18 1F E8 C8 CC 50 03
D0 F3 4C C1 39 20 DD 36 20 D2 34 4C 7D
39 4C 48 3A 20 D2 34 A2 00 BD 00 1F D0
08 E8 E0 18 D0 F5 4C AB 2E 8A 86 00 A2
00 0A 0A 0A A8 B9 18 1F C9 00 F0 00 9D
61 03 C8 E8 4C 60 3A 8F 60 03 A6 00 AD
60 03 CD 52 03 D0 D3 A2 00 BD 61 03 DD
51 03 D0 20 E8 EC 50 03 D0 F2 A6 00 8A
0A A4 BD 80 1E 85 2B E8 BD 80 1E 85 2C
A0 00 BD D0 1F 85 2A 60 08 22 A6 00 4C
4F 3A 20 DD 36 20 D2 34 A9 20 8D 42 03
AD 51 03 C9 2B F0 12 C9 2D F0 0E C9 30
33 07 C9 3A 10 03 4C E5 3A 4C 42 3A CC
50 03 AD 51 03 8D 42 03 A2 00 BD 52 03
9D 51 03 E8 E0 05 D0 F5 A2 00 8D 50 03
9D 3C 03 E8 E0 06 D0 F5 20 85 34 20 7D
34 60 20 A0 3A 4C 08 22 F5 A5 2A C9 2D
F0 18 A5 6B 85 62 A5 6C 85 63 A5 2B 85
6B A5 2C 85 6C A5 62 85 2B A5 63 85 2C
60 20 00 38 A9 2B 85 2A A5 2B 49 FF 85
2B A5 2C 49 FF 85 2C A5 2B 18 69 01 85
2B A5 2C 69 00 85 2C 20 62 38 B0 1D A5
2B 49 FF 85 2B A5 2C 49 FF 85 2C A5 2B
18 69 01 85 2B A5 2C 69 00 85 2C A9 2D
85 2A 60 A5 2B 18 65 6B 85 2B A5 2C 65
6C 85 2C 60 A5 2A 85 6A A5 2B 85 6B A5
2C 85 6C 20 A6 3A 60 20 70 3B A5 2A C5
6A F0 06 20 1F 3B 4C 08 22 20 D2 3B 4C
08 22 20 70 3B A5 2A C5 6A F0 05 20 D2
3B 4C BE 3B A9 2D 8D 23 3B A9 2B 8D 5F
3B 20 1F 3B A9 2B 8D 23 3B A9 2D 8D 5E
3B 4C 08 22 A5 2A C9 2B F0 07 A9 2D 85
2A 4C 08 22 A9 2D 85 2A 4C 08 22 A5 2B
18 65 6B 85 2B A5 2C 65 6C 85 2C B0 01
60 4C 00 20 A5 6B 18 65 2B 85 6B A5 6C
65 2C 85 6C 60 F5
CHECKSUM= 49274
 15360
20 70 3B A5 2B 85 6D A5 2C 85 6E A9 00
85 2B 85 2C A5 6A C5 2A F0 07 A9 2D 85
2A 4C 22 3C A9 2B 85 2A A5 6E D0 04 A5
6D F0 13 20 D2 3B A5 6D 18 69 FF 85 6D
A5 6E 69 FF 85 6E 4C 22 3C 4C 08 22 20
70 3B A9 00 85 33 85 34 A5 2B D0 07 A5
2C D0 03 4C C0 2E A5 2A C5 6A F0 07 A9
2D 85 2A 4C 65 3C A9 2B 85 2A A5 2B 49
FF 85 2B A5 2C 49 FF 85 2C A5 2B 18 69
01 85 2B A5 2C 69 00 85 2C 20 E5 3B 90
10 A5 33 18 69 01 85 33 A5 34 69 00 85
34 4C 7E 3C A5 33 85 2B A5 34 85 2C 4C
08 22 FD
CHECKSUM= 15752
 15771
FF FD
CHECKSUM= 508
 15872
20 20 20 16 09 03 20 14 05 18 14 20 05
04 09 14 0F 12 2E 20 20 20 20 20 20 20
20 20 20 20 20 20 20 20 20 20 20 20 20
20 20 20 20 20 20 20 55 40 40 40 40 40
40 40 40 40 40 40 40 40 40 40 40 49 20
20 20 20 5D 20 20 20 20 20 20 20 20 20
20 20 20 20 20 20 20 5D 20 20 20 20 5D
20 20 20 20 20 20 20 20 20 20 20 20 20
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20 20 20 20 20 20 20 20 20 20 20 20 20
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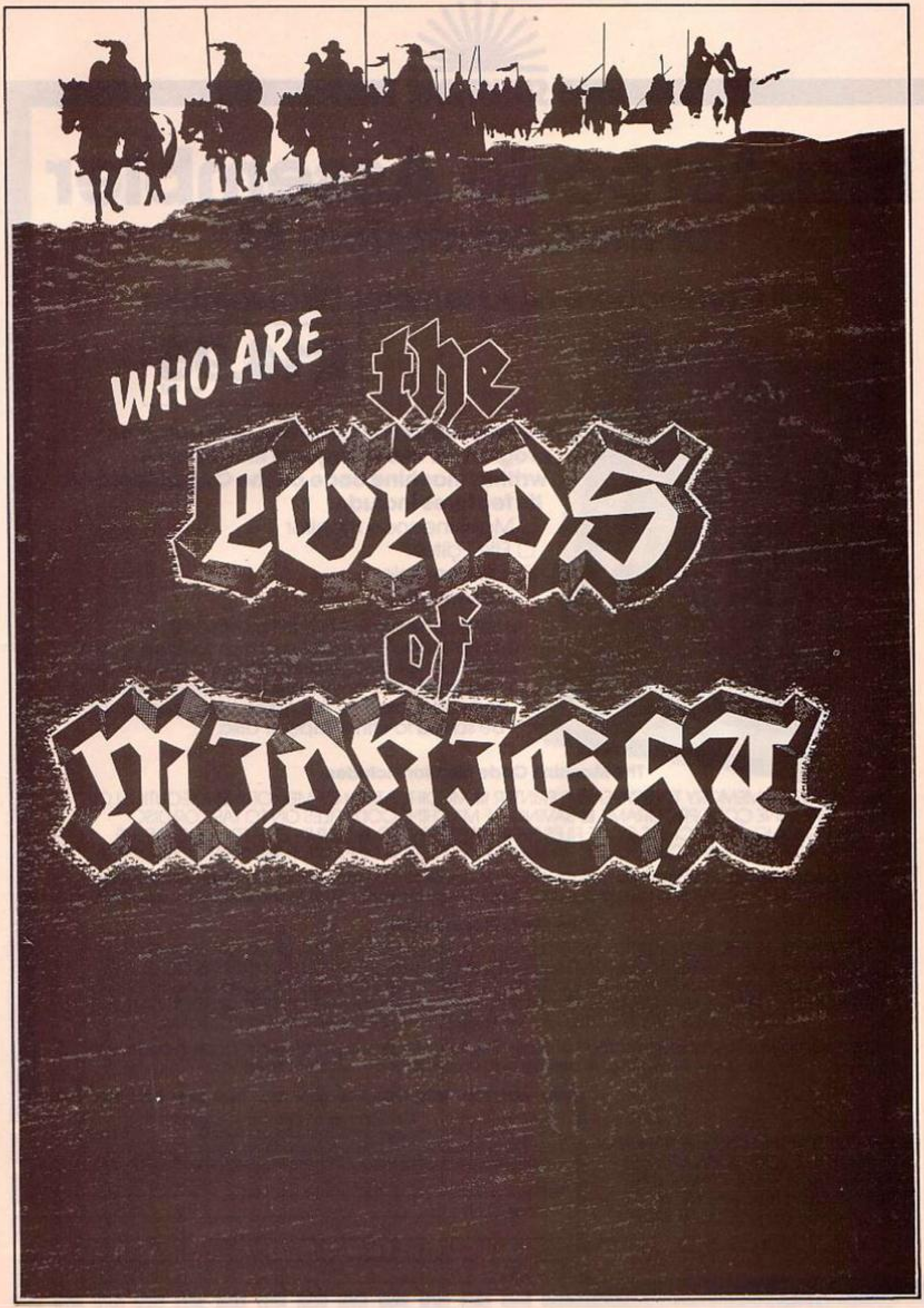
20 20 20 20 20 20 20 20 20 20 20 20 5D
20 20 20 20 4A 40 40 40 40 40 40 40 40
40 40 40 40 40 40 40 40 4B 20 20 20 20
03 0F 10 19 12 09 07 08 14 20 28 03 29
31 39 38 33 2E 20 20 20 20 20 20 20 20
20 20 20 20 20 20 20 20 20 20 20 20 20
20 20 20 20 20 20 20 20 20 0A 2E 0C 01
17 12 05 0E 03 05 20 20 20 20 20 20 FD
CHECKSUM= 19110
```

Figure 3.

```
5 IFC>0THENSYS9472
7 C=C+1
10 POKE 37150,127
20 POKE 37151,127
30 POKE36879,110:PRINT"s±";CHR$(8);
40 PRINT"      VIC CESIL.QQ"
50 PRINT"£QQCOMPUTER EDUCATION IN QSCHOO
LS INSTRUCTION   QLANGUAGE."
60 PRINT"QQE FOR THE VIC + 8K BY"
70 PRINT"QQe       K.LAWRENCEE"
80 LOAD"",1,1
90 SYS9472
100 END
110 REM
115 REM
120 REM"s" = SHIFT/CLR
130 REM"±" = CTRL/6
140 REM"Q" = CRSR DOWN
150 REM"£" = CTRL/8
160 REM"E" = CTRL/2
170 REM"e" = CTRL/1
```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for the Commodore 64

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- ☐ Machinecode monitor
- ☐ File Editor
- ☐ Disassembler
- ☐ Assembler

Mastercode is a full two pass assembler. It accepts labels, variables and equations within assembly language programs. It is possible to store programs anywhere in memory, even in parts occupied by the Assembler. Programs can be saved to either tape or disc.

The Machine Code Monitor includes:

■ OUTPUT OF MEMORY TO SCREEN OR PRINTER ■ MODIFICATION OF MEMORY ■ EXECUTION OF MACHINE CODE PROGRAMS ■ SAVING OF MACHINE CODE FILES ON TO TAPE OR DISC ■ LOADING OF MACHINE CODE FILES FROM TAPE OR DISC ■ STEP BY STEP TRACING OF THE EXECUTION OF A MACHINE CODE PROGRAM, INCLUDING DISPLAY OF REGISTER CONTENTS.

The Disassembler will translate into assembly language the contents of any area of memory, whether the 64's ROM or a user program. Output may be sent either to the screen or a printer.

The File Editor includes:

■ ENTRY OF NUMBERED LINES OF ASSEMBLY LANGUAGE INSTRUCTIONS ■ LISTING, INDIVIDUALLY OR IN BLOCKS, OF PREVIOUSLY ENTERED LINES ■ DELETION, INDIVIDUALLY OR IN BLOCKS, OF EXISTING LINES ■ RENUMBERING OF EXISTING LINES ■ SAVING OF ASSEMBLY LANGUAGE FILES TO TAPE OR DISC ■ LOADING OF ASSEMBLY LANGUAGE FILES FROM TAPE OR DISC ■ ADDITION OF A BLOCK OF MEMORY SPECIFIED BY THE USER TO THE USER'S ASSEMBLY PROGRAM

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Signature ______

G Bailey saves the princess.

ORIC KRAZY APE

THE OBJECT OF Krazy Ape is to rescue the princess from the clutches of the angry age at the top of the platform. To do this you must climb up the platforms using the ladders. This may sound easy but the ape rolls barrels down to try and stop your attempt. You must jump over these barrels to stay alive by the means of the space bar or the fire button on a joystick. You have three lives to start off with.

You move your man by the four cursor keys

(continued on page 111)

```
NOTE: FOR '_' READ POUND SIGN
0 HIMEM#9800
1 REM *** KRAZY APE (C) G.Bailey ***
2 GOSUB9000 'MACHINE CODE & UDG'S
3 GOSUB 2000
4 DOKE#0229,#996D
5 LL=3:SK=45:LV=1
8 GOSUB 1000
10 GOTO 100
49 REM ** JOYSTICK **
50 PK=PEEK(#BFFF)
51 IFPK>76ANDPK<96ANDGH=0THEN560
52 IF PK=111 ANDUP=1THEN540
54 IF PK=111 ANDGH=0ANDSCRN(X,Y-2)=77THEN540
56 IF PK=125ANDGH=0THEN520
58 IF PK=126ANDGH=0THEN500
60 IF PK=119ANDGH=0THEN580
62 GOTO 300
100 REM ** LOOP **
110 CALL#400
120 BO=800
150 X=6:Y=24
160 GOTO200
199 PLOT 27,9,66:A=0:CALL#400:GOTO280
200 REPEAT
205 PLOT4,25,32:PLOT3,24,96
215 PLOT29,2,7
250 CALL#9800
270 A=INT(RND(1)*50):IFA>SKANDSCRN(30,9)<>50 THEN199
272 IF A>SKTHENCALL#400
278 IF SCRN(X,Y+1)=66THENPING:GOTO700
279 IF JOY=1 THEN 50
280 K$=KEY$
288 IFK$=CHR$(10)ANDGH=0THEN580
290 IF K$=CHR$(8)ANDGH=0THEN500
292 IF K$=CHR$(9)ANDGH=0THEN520
293 IF K$=CHR$(11)ANDUP=1THEN540
294 IF K$=CHR$(11)ANDGH=0ANDSCRN(X,Y-2)=77THEN540
296 IF K$=" "ANDGH=0THEN560
300 IF GH=1 THEN JM=JM+1
310 IF JM=3 THEN 570
320 PLOT9,2,STR$(SC)
325 BO=BO-1:PLOT22,2,STR$(BO)
400 REM
410 UNTIL SCRN(18,5)=87ORBO=0
420 IF BO=0THEN700
421 ZAP:ZAP
425 SK=SK-2:IFSK=33THENSK=35
430 SC=SC+BO:LV=LV+1
440 WAIT300:UP=0:NB=0:GH=0:JM=0
450 GOTO8
499 END
500 IFSCRN(X-1,Y+1)<>32ANDSCRN(X-1,Y)<>77THEN400
501 IF SCRN(X,Y+2)=32THENPING :GOTO700
502 PLOT X,Y,32:PLOTX,Y+1,32:X=X-1:PLOTX,Y,"P":PLOTX,
```

(listing continued on page 111)

BEYOND
CHALLENGING SOFTWARE
UP PERISCOPE
RUNS ON DRAGON 32
Death lurked under every wave
Goodness Gracious
RUNS ON COMMODORE 64
S.S. Achilles
ATARI 400/800 WITH 48K
Red Alert Alien Intruder
RUNS ON SPECTRUM IN 48K
Zebra
STOP statement, 110:1

ANOTHER
NEW
PROGRAM
KRIEGSPIEL:
A thrilling game of strategy to be played against the Dragon or any other devious opponent.
ENEMY TANK
Dead Ahead
Aaargh!!
a Minefield
... How much longer can we hold this town...?

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with
Superbase 64
The complete information control system for the Commodore 64.
The World Famous Commodore 64.
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Design your layout using text, numeric, calculated result, date, linking and key fields
Record size up to 1100 characters spread over up to 127 items
Number of records limited only by your equipment: can be thousands
As many databases as you want – each with up to 15 files
Learn fast through built-in HELP screens – then add your own notes
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Keyed records for high speed retrieval – 3 secs for any file size
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Links to other programs and EASY SCRIPT for mailshots, high-quality letters, quotes, tables, etc.
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Easy to understand menus
Add or amend fields, or alter length – no file rebuilding needed
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Display quantities, values, totals, as you enter them.
Formulas for on-screen result calculation
Superbase 64
Precision Software
Precision Software Limited,
Park House, 4 Park Terrace,
Worcester Park,
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Telex: 8955021 PRECIS G
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commodore

(continued from page 107)
or by a joystick. He can be moved left, right, up and down. On the way he can collect objects which offer bonus points.

When all your lives are exhausted the game ends and a high score table is shown. If you have been lucky and beaten one of the high scores then you will be required to enter your initials.

10 points are given for every step you take, and the bonus is added to your score at the end of every sheet.

The program takes up nearly 12K and is a combination of Basic and machine code. The machine code is used to move the barrels and to give the effect of the ape rolling a barrel down the platforms. The technique used in this effect is a two picture technique. UDG's make up a picture of the ape holding and rolling a barrel.

There are 64 UDG's in the program. Nearly 30 of these go to make up both apes.

The joystick which I wrote the program on was a Spectravideo Quickshot, using a Pasesoft interface. If you are using this set up, then the joystick should be plugged into the left side of the interface. If for some reason it is not possible to use the left hand side, and right has to be used, then the values in the lines 50-60 must be altered.

(listing continued from page 107)

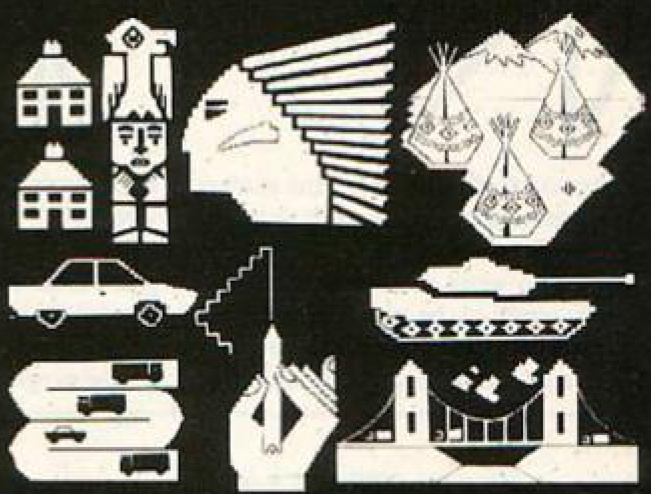
```
Y+1,"Q"
 505 F1$="P":F2$="Q"
 506 IF SCRN(X-1,Y)<>32 AND SCRN(X-1,Y)<>77THEN600
 508 SC=SC+10:PLOT9,2,STR$(SC)
 509 BO=BO-1:PLOT22,2,STR$(BO)
 510 GOTO400
 520 IFSCRN(X+1,Y+1)<>32ANDSCRN(X+1,Y)<>77THEN400
 521 IF SCRN(X,Y+2)=32THENPING:GOTO700
 522 PLOT X,Y,32:PLOTX,Y+1,32:X=X+1:PLOTX,Y,"N":PLOTX,
Y+1,"O"
 525 F1$="N":F2$="O"
 526 SC=SC+10:PLOT9,2,STR$(SC)
 527 BO=BO-1:PLOT22,2,STR$(BO)
 530 GOTO400
 540 REM
 541 IF SCRN(X,Y-2)=36THEN400
 543 IFSCRN(X,Y-2)<>77ANDUP=0THEN400
 544 PLOTX,Y,32:PLOTX,Y+1,32:Y=Y-1
 545 PLOTX,Y+2,"M":PLOTX,Y+1,"X":PLOTX,Y,"W"
 546 IF CS<>32THENUP=1
 547 IF UP=1 THEN NB=NB+1:IFNB=4THENNB=0:UP=0
 550 SC=SC+10:GOTO400
 560 IF SCRN(X,Y-1)=92ORSCRN(X,Y-1)=82THEN600
 561 IFSCRN(X,Y-1)<>32THEN400
 562 PLOTX,Y,32:PLOTX,Y+1,32:Y=Y-1:PLOTX,Y,F1$:PLOTX,Y
+1,F2$:GH=1
 565 GOTO400
 570 IF SCRN(X,Y+2)=66THENPING:GOTO700
 575 PLOTX,Y,32:PLOTX,Y+1,32:Y=Y+1:PLOTX,Y,F1$:PLOTX,Y
+1,F2$
 576 GH=0:JM=0:SC=SC+10
 578 GOTO400
 580 IF SCRN(X,Y+2)=36 OR SCRN(X,Y+2)=32 THEN400
 582 Y=Y+1:PLOTX,Y,"W":PLOTX,Y+1,"X"
 583 PLOTX,Y-1,32
 584 IF NB<>0THENNB=NB-1
 586 PU=SCRN(X,Y+2)
 588 IF PU=36 THEN PLOTX,Y-1,"M":PLOTX,Y-2,"M"
 590 GOTO400
 600 REM PICK UP
 605 PU=SCRN(X-1,Y-1):UP=SCRN(X,Y-1)
 610 PLOTX-2,Y-1,32:PLOTX-1,Y-1,32:PLOTX,Y-1,32:PLOTX-
1,Y,32
 620 IF PU=84 THEN SC=SC+100
 622 IF PU=93 THEN SC=SC+200
 624 IF UP=92 THEN SC=SC+300
 626 IF UP=82 THEN SC=SC+500
 630 GOTO400
 700 REM ** DIE **
 710 LL=LL-1
 720 IF LL=0THEN800
 730 WAIT300:GH=0:UP=0:JM=0:NB=0:GOTO8
 800 REM ** END **
 805 WAIT 300
 810 PRINTCHR$(12)
 815 PAPER3:INK0
 820 IF SC<HI(4)THEN864
 825 A$(4)=""
 830 PLOT12,5,"NEW HIGH SCORE":PLOT12,6,"ENTER INITIAL
S"
 835 PLOT10,4,16:PLOT10,7,16:PLOT10,5,CHR$(16)+CHR$(1)
 840 PLOT 10,6,CHR$(16)+CHR$(6):FORT=4TO7:PLOT28,T,19:
NEXT
 850 FORT=11TO12:PLOT16,T,CHR$(10)+"- - -":NEXT
 852 IN=17:A$(4)="":HI(4)=SC
 854 FORT=1TO3
 856 K$=KEY$:IF K$="" OR K$=" " THEN856
 857 PLAY 2,0,0,0:SOUND2,200,10:PLAY0,0,0,0
 858 IF ASC(K$)<32THEN856
 859 A$(4)=A$(4)+K$
 860 PLOT IN,11,K$:PLOTIN,12,K$
 862 IN=IN+2:NEXT
 864 CLS
 866 FORT=3TO4:PLOT7,T,CHR$(14)+"KRAZY APE HALL OF FAM
E":NEXT
 868 FORK=0TO4:FORL=K+1TO5:IFHI(L)<=HI(K)THEN 874
 870 U=HI(L):U$=A$(L):HI(L)=HI(K):A$(L)=A$(K)
 872 HI(K)=U:A$(K)=U$
 874 NEXT L
 876 NEXT K
 877 PLAY 0,0,0,0
 878 FORT=7TO8:PLOT6,T,CHR$(17)+CHR$(7)+CHR$(10)+"1)":
PLOT32,T,19:NEXT
 880 PLOT 14,7,A$(0):PLOT14,8,A$(0)
 882 K$=MID$(STR$(HI(0)),2,6):PLOT24,7,K$:PLOT24,8,K$
 884 NU=2:FORT=10TO13
 885 PLAY 1,0,0,0:SOUND 1,50*T,10
 886 PLOT6,T,CHR$(21)+" "+CHR$(7)+MID$(STR$(NU),2,6)+"
)"
 888 PLOT 14,T,A$(NU-1):PLOT24,T,MID$(STR$(HI(NU-1)),2
,6)
 890 PLOT 32,T,19:NU=NU+1:NEXT
 892 T1$="?<963":T2$="@=:74":T3$="A>;85"
 894 FORT=17TO18:PLOT16,T,CHR$(11)+T1$:NEXT
 896 FORT=19TO20:PLOT16,T,CHR$(11)+T2$:NEXT
 898 FORT=21TO22:PLOT16,T,CHR$(11)+T3$:NEXT
 900 PLOT9,15,"Another Game (Y/N) ?"
 902 PLAY 0,0,0,0
 904 REPEAT:K$=KEY$:UNTILK$="Y"ORK$="N"
 906 IF K$="N"THENEND
 908 GH=0:NB=0:UP=0:SC=0:JM=0
 910 PLOT9,15,"Instructions (Y/N) ?"
 912 REPEAT:K$=KEY$:UNTILK$="Y"ORK$="N"
 914 IF K$="Y"THENGOSUB2102:GOTO5
 916 PLOT8,15,"JOYSTICK CONTROL (Y/N)"
 918 REPEAT:K$=KEY$:UNTILK$="Y"ORK$="N"
 920 IFK$="Y"THENJOY=1ELSEJOY=0
 925 GOTO 5
 999 END
 1000 REM *** SCREEN ***
 1002 CLS
 1005 PAPER0:INK2:POKE#26B,9
 1010 PRINTCHR$(12):POKE#26A,10:POKE48035,0
 1020 G$=CHR$(1)+"$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$"
 1025 PLOT1,26,G$+"$$$$$"
 1030 PLOT 1,22,G$:PLOT5,18,G$:PLOT1,14,G$:PLOT5,10,G$
 1040 PLOT30,7,A$:PLOT30,8,B$:PLOT30,9,C$
 1045 PLOT18,7,"$$$$$$":FORT=4TO9:PLOT18,T,"M":NEXT
 1050 PLOT29,9,3:PLOT29,8,3:FORT=9TO25STEP4:PLOT1,T,7:
NEXT:PLOT17,7,1
 1055 FORT=4TO6:PLOT19,T,3:NEXT:PLOT25,6,3:PLOT19,6,5
 1056 PLOT 17,6,2:PLOT29,7,3
 1060 PLOT20,4,"FC":PLOT20,5,"GD":PLOT20,6,"HE"
 1065 FORT=5TO6:PLOT22,T,CHR$(7)+CHR$(15)+"IJKL"+CHR$(
3):NEXT
 1070 FORT=14TO17:PLOT33,T,"M":PLOT33,T+8,"M"
 1075 NEXTT:FORT=10TO13:PLOT6,T,"M":PLOT6,T+8,"M":NEXT

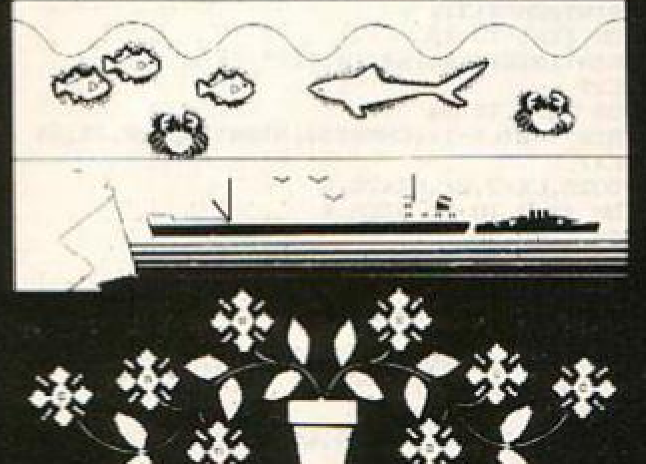
 1080 PLOT 4,2,"SCORE ":PLOT30,2,"LEVEL":PLOT35,2,STR$
(LV)
 1081 T$="BONUS":FORT=1TOLEN(T$):PLOT16+T,2,ASC(MID$(T
$,T,1))+128
 1082 NEXT T:PLOT15,2,6:PLOT23,2,"000"
 1085 PLOT0,2,8:A=2
 1090 FORT=1TOLL:A=A+2:PLOTA,5,"N":PLOTA,6,"O":NEXT
 1095 PLOT1,6,5
 1100 IFSK=45ORSK=43THENPLOT14,11,"UTS":PLOT15,12,"V":
PLOT15,19,"UTS"
 1105 IFSK=45ORSK=43THENPLOT12,11,6:PLOT12,19,5:PLOT16
,20,"V"
 1110 IFSK=41THENPLOT15,11,"Y]Z":PLOT16,12,"[":PLOT15,
19,"Y]Z":PLOT16,20,"["
 1115 IFSK=41THENPLOT14,11,3:PLOT12,19,6
 1120 IFSK=39THENPLOT12,11,"\":PLOT30,11,"\":PLOT11,11
,6
 1125 IFSK=39THENPLOT16,19,"\":PLOT15,19,6
 1130 IFSK=37THENPLOT13,11,"R":PLOT28,11,"R":PLOT10,19
,"R":PLOT29,19,"R"
 1135 IFSK=37THENPLOT12,11,7:PLOT9,19,7
 1140 PLOT2,24,"^"+CHR$(96):PLOT2,25,"_a"
 1145 PLOT1,25,2:PLOT4,25,7
 1150 PLOT36,26,"   "
 1160 RETURN
 2000 REM ** TITLE PAGE **
 2005 PAPER0:INK7:POKE#26B,9:CLS
 2006 FORT=1TO5:PRINT:NEXT
 2010 POKE48035,0:POKE#26A,10
 2015 PRINT"   $  $    $$$      $$     $$$$   $  $"
 2020 PRINT"   $ $     $  $    $  $       $   $  $"
 2025 PRINT"   $$      $  $    $  $     $$    $  $"
 2030 PRINT"   $ $     $$$     $$$$    $        $$ "
 2035 PRINT"   $  $    $  $    $  $    $$$$     $$ "
 2040 FORT=1TO3:PRINT:NEXT
```

(listing continued on page 112)

(listing continued from page 111)

```
 2050 PRINTSPC(10)" $$    $$$    $$$$"
 2055 PRINTSPC(10)"$  $   $  $   $   "
 2060 PRINTSPC(10)"$  $   $  $   $   "
 2065 PRINTSPC(10)"$$$$   $$$    $$$$"
 2066 PRINTSPC(10)"$  $   $      $   "
 2068 PRINTSPC(10)"$  $   $      $   "
 2070 PRINTSPC(10)"$  $   $      $$$$"
 2075 C=1:FORT=5TO9:PLOT3,T,C:PLOT10,T,C+1:PLOT17,T,C+
2:PLOT24,T,C+3
 2080 PLOT31,T,C+4:NEXT
 2090 PLOT10,24,CHR$(8)+"By G.Bailey"
 2095 PLOT9,24,5
 2100 WAIT300
 2102 PRINTCHR$(12):PAPER0:INK3
 2105 PLOT13,2,CHR$(1)+"KRAZY APE":FORT=1TO4:PRINT:NEX
T
 2110 PRINT" You have to rescue the princess from"
 2115 PRINT"the clutches of the angry ape who is"
 2120 PRINT"rolling barrels down the platforms to"
 2125 PRINT"try and stop you.You must dodge these"
 2130 PRINT"barrels by jumping over them."
 2135 PRINT:PRINT:PRINT" Extra points ..."
 2140 PLOT1,14,CHR$(5)+CHR$(9)+"UTS":PLOT3,15,CHR$(9)+
"V"+CHR$(8)
 2142 PLOT8,15,"... 100"
 2144 PLOT20,14,CHR$(9)+CHR$(6)+"Y]Z":PLOT22,15,CHR$(9
)+"["+CHR$(8)
 2146 PLOT27,15,"... 200"
 2148 PLOT2,19,CHR$(9)+CHR$(1)+"\   ... 300":PLOT7,19,
8
 2150 PLOT21,19,CHR$(7)+CHR$(9)+"R   ... 500":PLOT27,1
9,8
 2152 FORT=1TO10:PRINT:NEXT
 2154 PRINT" Use the cursor key to move, and the  ";"s
pace bar to jump."
 2156 PLOT8,26,CHR$(12)+CHR$(2)+"Press SPACE to play"
 2158 REPEAT:UNTILKEY$=" "
 2160 CLS
 2165 PLOT8,13,"JOYSTICK CONTROL (Y/N)"
 2170 REPEAT:K$=KEY$:UNTILK$="Y"ORK$="N"
 2175 IF K$="Y"THENJOY=1ELSEJOY=0
 2180 RETURN
 2999 END
 9000 REM *** UDG's ***
 9010 FORT=#B800+(8*36)TOT+495
 9020 READ D:POKET,D:NEXT T
 9030 DATA 63,12,12,18,18,33,33,63
 9040 DATA 0,0,0,0,0,32,48,48,60,63,51,24,20,40,48,32
 9045 DATA 0,0,0,0,0,0,0,32,16,48,24,60,31,63,63,63
 9050 DATA 63,63,31,63,14,0,0,1,0,0,32,16,40,36,35,7
 9055 DATA 13,54,63,63,63,63,61,63,53,42,21,42,31,11,2
1,63
 9060 DATA 14,17,32,35,20,32,0,1,18,36,9,51,15,55,15,1
5
 9065 DATA 31,31,63,63,60,60,56,1,0,0,0,1,1,3,28,32
 9070 DATA 32,31,16,8,4,3,0,0,0,30,33,29,5,29,33,30
 9075 DATA 0,0,0,0,48,56,60,62,62,62,61,61,61,61,58,4
 9080 DATA 56,0,0,0,0,32,48,0,0,0,63,15,23,11,5
 9085 DATA 57,3,63,63,31,31,31,63,52,3,60,60,22,42,53,
63
 9090 DATA 0,28,34,1,20,1,62,0,63,0,29,62,63,63,63,62
 9095 DATA 29,0,63,33,33,0,0,0,0,0,63,56,53,40,16
 9100 DATA 15,32,63,62,61,61,61,62,47,56,15,15,26,21,4
3,63
 9105 DATA 0,0,0,0,3,7,15,31,31,31,47,47,47,39,23,8
 9110 DATA 7,0,0,0,0,0,1,3,12,30,59,55,47,61,30,12
 9120 DATA 0,0,48,56,60,56,24,52,2,60,48,58,36,40,48,6
3,48,48,56,56,56,60,0,32
 9125 DATA 0,0,7,7,15,8,9,41,56,57,9,9,7,7,7,15,15,15,
31,31,31,63,6,7
 9130 DATA 0,0,0,34,62,34,0,0,0,0,62,32,62,32,62,0,0,3
2,32,32,32,32,62,0
 9135 DATA 62,33,33,62,32,32,32,32
 9140 DATA 33,33,63,33,33,63,33,33
 9150 DATA 62,63,30,31,30,12,30,54,55,48,63,30,30,12,1
2,14
 9155 DATA 31,63,30,62,30,12,30,27,61,1,63,30,30,12,12
,28
 9160 DATA 12,12,30,63,63,30,12,12
 9165 DATA 0,32,48,56,60,62,63,15,30,51,51,51,33,0,51,
12
 9170 DATA 0,1,3,7,15,31,63,60,4,4,4,4,4,36,36,24
 9175 DATA 0,30,63,63,63,30,30,63,63,63,63,30,30,12,12
,12
 9180 DATA 31,31,25,25,25,25,25,31,62,62,38,38,38,38,3
8,62 'HAMMER
 9185 DATA 12,12,12,12,12,12,12,0,51,51,63,63,30,30,12
,0
 9190 DATA 63,63,63,63,63,63,63,63
 9200 DATA 42,38,25,63,31,31,32,46,42,42,42,46,32,31,3
1,63
 9210 DATA 25,55,34,63,62,62,1,41,41,41,41,45,1,62,62,
63
 10000 REM **** MACHINE CODE ****
 10005 FORT=1TO79:READD:POKE#3FF+T,D:NEXT
 10010 DATA #A2,#00,#BD,#C8,#AF,#9D,#DF,#BC,#E8,#E0,#5
,#D0,#F5
 10015 DATA #A2,#00,#BD,#CD,#AF,#9D,#07,#BD,#E8,#E0,#5
,#D0,#F5
 10020 DATA #A2,#00,#BD,#D2,#AF,#9D,#2F,#BD,#E8,#E0,#5
,#D0,#F5
 10025 REM *** MOVE DATA ***
 10030 DATA #A2,#00,#BD,#C8,#AF,#9D,#F0.#AF.#E8.#F0 #F
,#D0,#F5
 10035 DATA #A2,#00,#BD,#DC,#AF,#9D,#C8,#AF,#E8,#E0,#F
,#D0,#F5
 10040 DATA #A2,#00,#BD,#F0,#AF,#9D,#DC,#AF,#E8,#E0,#F
,#D0,#F5,#60
 10050 FORT=0TO14:READD:POKE#AFC8+T,D:NEXT
 10055 FORT=0TO14:READD:POKE#AFDC+T,D:NEXT
 10060 DATA#30,#2D,#2A,#27,#20,#31,#2E,#2B,#28,#25,#32
,#2F,#2C,#29,#26
 10065 DATA#3F,#3C,#39,#36,#33,#40,#3D,#3A,#37,#34,#41
,#3E,#3B,#38,#35
 10068 FORT=0TO364:READD:POKE#9800+T,D:NEXT
 10070 DATA #A2,#17,#A0,#00,#BD,#15,#BD,#A8,#C0,#42,#F
0,#8,#CA,#E0,#00
 10072 DATA #D0,#F3,#4C,#22,#98
 10074 DATA #A9,#20,#9D,#15,#BD,#98,#CA,#9D,#15,#BD,#C
A,#4C,#0D,#98
 10076 DATA #AE,#23,#BD,#E0,#20,#F0,#3
 10078 DATA #4C,#31,#98
 10080 DATA #A9,#4D,#8D,#23,#BD
 10082 DATA #AE,#15,#BD,#8E,#B5,#BD,#A2,#20,#8E,#15,#B
D
 10084 DATA #A2,#00,#A0,#00,#BD,#B5,#BD,#A8,#C0,#42,#F
0,#8
 10086 DATA #E8,#E0,#1F,#D0,#F3 '76
 10088 DATA #4C,#5E,#98
 10090 DATA #A9,#20,#9D,#B5,#BD,#98,#E8,#9D,#B5,#BD,#E
8,#4C,#49,#98
 10092 DATA #AE,#B7,#BD,#E0,#20,#F0,#3
 10094 DATA #4C,#6D,#98 '103
 10096 DATA #A9,#4D,#8D,#B7,#BD
 10098 DATA #AE,#D4,#BD,#8E,#74,#BE,#A2,#20,#8E,#D4,#B
D
 10100 DATA #A2,#1F,#A0,#00,#BD,#55,#BE,#A8,#C0,#42,#F
0,#8,#CA,#E0,#00
 10102 DATA #D0,#F3,#4C,#9A,#98 '139
 10104 DATA #A9,#20,#9D,#55,#BE,#98,#CA,#9D,#55,#BE,#C
A,#4C,#85,#98
 10106 DATA #AE,#72,#BE,#E0,#20,#F0,#3
 10108 DATA #4C,#A9,#98 '163
 10110 DATA #A9,#4D,#8D,#72,#BE
 10112 DATA #AE,#55,#BE,#8E,#F5,#BE,#A2,#20,#8E,#55,#B
E
 10114 DATA #A2,#00,#A0,#00,#BD,#F5,#BE,#A8,#C0,#42,#F
0,#8
 10116 DATA #E8,#E0,#1F,#D0,#F3 '196
 10118 DATA #4C,#D6,#98
 10120 DATA #A9,#20,#9D,#F5,#BE,#98,#E8,#9D,#F5,#BE,#E
8,#4C,#C1,#98
 10122 DATA #AE,#F7,#BE,#E0,#20,#F0,#3
 10124 DATA #4C,#E5,#98 '223
 10126 DATA #A9,#4D,#8D,#F7,#BE
 10128 DATA #AE,#14,#BF,#8E,#B4,#BF,#A2,#20,#8E,#14,#B
F
 10130 DATA #A2,#1F,#A0,#00,#BD, 95,#BF,#A8,#C0,#42,#F
0,#8,#CA,#E0,#00
 10132 DATA #D0,#F3,#4C,#12,#99
 10134 DATA #A9,#20,#9D,#95,#BF,#98,#CA,#9D,#95,#BF,#C
A,#4C,#FD,#98 '273
 10136 DATA #AE,#B2,#BF,#E0,#20,#F0,#3
 10138 DATA #4C,#21,#99
 10140 DATA #A9,#4D,#8D,#B2,#BF
 10142 DATA #AE,#FB,#BC,#E0,#20,#F0,#3
 10144 DATA #4C,#30,#99
 10146 DATA #A9,#4D,#8D,#FB,#BC
 10148 DATA #AE,#BF,#BD,#E0,#20,#F0,#3
 10150 DATA #4C,#3F,#99 '313
 10152 DATA #A9,#4D,#8D,#BF,#BD
 10154 DATA #AE,#4A,#BE,#E0,#20,#F0,#3
 10156 DATA #4C,#4E,#99
 10158 DATA #A9,#4D,#8D,#4A,#BE
 10160 DATA #AE,#CF,#BE,#E0,#20,#F0,#3
 10162 DATA #4C,#5D,#99
 10164 DATA #A9,#4D,#8D,#CF,#BE
 10166 DATA #AE,#BA,#BF,#E0,#20,#F0,#3
 10168 DATA #4C,#6C,#99
 10170 DATA #A9,#4D,#8D,#BA,#BF
 10175 DATA #60
 10198 REM *** JOYSTICK ***
 10199 :
 10200 DATA #48,#AD,#01,#03,#48,#AD,#03,#03,#48,#A9,#C
0
 10202 DATA #8D,#03,#03,#A9,#80,#8D,#0F,#03,#AD,#0F,#0
3,#8D,#FE,#BF
 10204 DATA #A9,#40,#8D,#0F,#03,#AD,#01,#03
 10206 DATA #8D,#FF,#BF,#68,#8D,#03,#03,#68,#8D,#0F,#0
3,#68,#4C,#03,#EC
 10208 MEM=#996D
 10210 READD:POKEMEM,D
 10212 IF D<>#EC THEN MEM=MEM+1:GOTO10210
 11000 RETURN
```





SPRITE ANIMATOR AND DEFINER

John Lenaghan produces a sprite command for the BBC.

MANY MICROCOMPUTERS now on the market have a sprite graphics routine built into the MOS. The BBC micro, unfortunately, does not, and trying to write your own using the VDU drivers tends to be slow. The sprite animation program given here will allow you to easily define and move a sprite around on a high-resolution screen by Poking data directly into screen RAM.

The definer program, program 1, will only give data for Mode 2 and therefore, is restricted to the Model B. Type in the program and run it.

The program is a series of procedures called up from a menu. Option 3 should be chosen initially. Numbers corresponding to the logical colour number in Mode 2 should be typed into the appropriate position. The cursor is moved around with the cursor control keys. Up to 16 colours can be used and the sprite is made up of 12 by 16 pixels.

Program 1.

```
10REM**** DEFINER VERSION 4 ****
20PROC_INIT
30REPEAT
40MODE 7
50menu%=FN_MENU
60IF menu%=1 MODE 7:PROC_NEW
70IF menu%=2 MODE 2:PROC_VIEW
80IF menu%=3 MODE 7:PROC_EDIT
90UNTIL menu%=0
100PROC_END
110END
120DEFPROC_INIT
130*TV 255
140*FX200,1
150DIM pixel% 190,byte% 95
160PROC_NEW
170*FX4,1
180table$="0123456789ABCDEF"
190copy$="COPY returns to menu"
200L%=1
210ENDPROC
220DEFPROC_EDIT
230PROC_COLOURS
240VDU23,0,10,128,0,0,0,0,0,0,19,1,2,0,0,0,31,L%+1,4
245PRINT;CHR$131;
250FOR I%=1 TO 12
260PRINT;MID$(table$,I%,1)+" ";
270NEXT
280FOR J%=1 TO 16
290PRINTTAB(L%-1);CHR$131;MID$(table$,J%,1)
300NEXT
310VDU28,L%+2,21,L%+25,5
320FOR X%=0 TO 20 STEP 4
330FOR Y%=0 TO 15
340element%=Y%*2+32*(X%DIV4)
350VDU 31,X%,Y%
360IF ?(pixel%+element%)=0 PRINT;"  "; ELSE PRINT;~?
(pixel%+element%);" ";
370IF ?(pixel%+element%+1)=0 PRINT;"  ";ELSE PRINT;~
?(pixel%+element%+1);" ";
380NEXT,
390VDU31,0,0,28,L%+2,20,L%+25,5
400REPEAT
410D%=INSTR(table$,GET$)
420IF (D%<>0 AND POS<24) PRINT;(MID$(table$,D%,1)+CH
R$(8));:?(pixel%+VPOS*2+32*(POS DIV 4)+(POS/2)MOD2)=D%
-1
430IF INKEY(-122) VDU 31,POS+2,VPOS
440IF INKEY(-26) VDU 31,POS-2,VPOS
450IF INKEY(-58) VDU 31,POS,VPOS-1
460IF INKEY(-42) VDU 31,POS,VPOS+1
470UNTIL INKEY(-106)
480ENDPROC
490DEFPROC_VIEW
500@%=4
510VDU31,0,7,17,6,19,1,1,0,0,0
520PRINT"Data:"'
530PROC_BYTES
540FOR I%=0 TO 88 STEP 8
550PRINT;" &";
560FOR J%=3 TO 0 STEP -1
570IF ?(byte%+I%+J%)<16 PRINT;"0";~?(byte%+I%+J%);EL
SE PRINT;~?(byte%+I%+J%);
580NEXT
590PRINT;",&";
600FOR J%=7 TO 4 STEP -1
610IF ?(byte%+I%+J%)<16 PRINT;"0";~?(byte%+I%+J%);EL
SE PRINT;~?(byte%+I%+J%);
620NEXT,
630FOR X%=0 TO 5
640FOR Y%=0 TO 15
650?(HIMEM+2832+8*X%+640*(Y%DIV8)+Y%MOD8)=?(byte%+Y%
+16*X%)
660NEXT,
670PRINTTAB(0,29);copy$
680REPEAT UNTIL INKEY(-106)
690ENDPROC
700DEFPROC_NEW
710FOR I%=0 TO 192
720?(pixel%+I%)=0
730NEXT
740ENDPROC
750DEFPROC_END
760*FX 4,0
770PRINT''"End of line"
780ENDPROC
790DEFPROC_BYTES
800FOR I%=0 TO 191 STEP 2
810J%=0
820FOR K%=0 TO 3
830IF ?(pixel%+I%)AND2^K% J%=J%+2^(2*K%+1)
840IF ?(pixel%+I%+1)AND2^K% J%=J%+2^(2*K%)
850NEXT
860?(byte%+I%DIV2)=J%
870NEXT
880ENDPROC
890DEFFN_MENU
900CLS
910PRINT;CHR$141;CHR$131;SPC10"DEFINER"
920PRINT;CHR$141;CHR$131;SPC10"DEFINER"
930PRINT''"Menu:"
940PRINT'SPC4"0)Escape from program"
950PRINT'SPC4"1)Reset for new char."
960PRINTSPC4" and to set width of char."
970PRINT'SPC4"2)View character and display data"
980PRINT'SPC4"3)Edit character"
990PRINT'''SPC5;CHR$130;copy$
1000REPEAT
1010val=INSTR("0123",GET$)
1020UNTIL val<>FALSE
1030=val-1
1040DEFPROC_COLOURS
1050VDU28,27,23,39,5
1060PRINT;CHR$(130);"0=Black"
1070PRINT;CHR$(130);"1=Red"
1080PRINT;CHR$(130);"2=Green"
1090PRINT;CHR$(130);"3=Yellow"
1100PRINT;CHR$(130);"4=Blue"
1110PRINT;CHR$(130);"5=Magenta"
1120PRINT;CHR$(130);"6=Cyan"
1130PRINT;CHR$(130);"7=White"
1140PRINT;CHR$(130);"8=Bl/Wh"
1150PRINT;CHR$(130);"9=Red/Cyan"
1160PRINT;CHR$(130);"A=Gr/Mag"
1170PRINT;CHR$(130);"B=Yell/Blue"
1180PRINT;CHR$(130);"C=Blue/Yell"
1200PRINT;CHR$(130);"D=Mag/Green"
1210PRINT;CHR$(130);"E=Cyan/Red"
1220PRINT;CHR$(130);"F=Wh/Black"
1225VDU26,31,8,22
1226PRINT;CHR$133;copy$
1230ENDPROC
```

When you are happy with the defined characters, record the data, read from left to right for the next program.

To light up any byte on the screen in Mode 2 use the expression:

address = HIMEM + 8 * X% + 640 * (Y% DIV 8) + Y% MOD 8

where X% and Y% have values in the range 0 to 79, and 0 to 255, respectively. X% and Y% equal to 79 and 255 respectively, corresponds to the bottom right hand edge of the screen.

Sprite is called up

Program 2 will demonstrate this by filling a block of yellow anywhere on the screen, 12 pixels wide and 16 pixels high. When I translated program 2 into assembly language, it took between 1 to 2 hundredths of a second for a single call. Program 3 is my attempt to speed it up.

Program 3 uses the fact that the difference in address between the top byte of a text character is 633 greater than the address of the bottom byte of the character above. This is tested for in line 120. The assembly listing for this program is shown in program 4.

A space must be set aside in memory for your data. This has to be done for each set of data bytes and is read into a byte array with the pling operator.

The sprite is now called up from your own program with Call statement with three parameters.

CALL sprite, X%, Y%, char %

Char %is the name of the character you want to move and X% and Y% is its new postion. As the sprite has been EOR to the screen it can be erased by a further:

CALL sprite, X%, Y% char %

without erasing the background. X% and Y% can be replaced by any upper or lower case integer variable.

Program renumbered

The program has been renumbered from 1,000 in steps of 10. This allows you 1,000 lines for your own program to sit below it in memory.

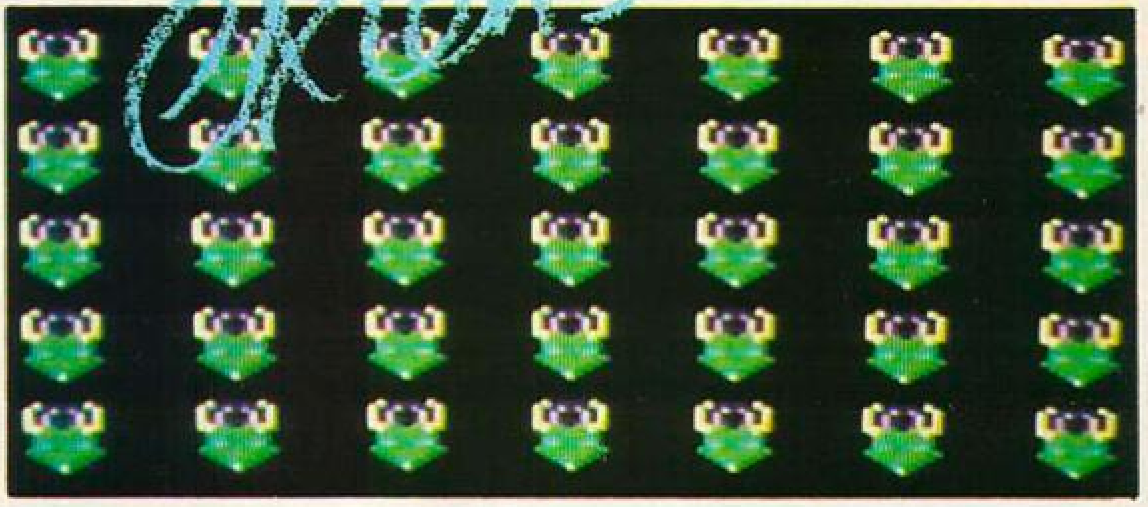
I would strongly advise saving the program before trying to run it as any mistake at this stage could easily result in a "Bad Program" error.

Page 403 of the User Guide explains how to merge your program with the sprite program.

Figure 1: Zero page4 locations used in the program

```
& 70  — X%
& 71  — Y%
& 72)
& 73) — X% * 8
& 74  — X% + 6
& 75  — Y% MOD 8
& 76  — (7 - Y% MOD 8)
& 77  — (15 - Y% MOD 8)
& 78
& 79  — Y% DIU 8 * 128
& 7A
& 7B  — Y% DIU 8 * 512
& 7C  — counter
& 7D  — addresslow
& 7E  — pointer
& 80  — pointer + 1
& 81  — temp
& 82  — temp + 1
& 83  — byte
```

GRAPHICS extensions



Program 2.

```
 10MODE 2
 20X%=50:Y%=100
 30PROC_ASSEMBLE(X%,Y%)
 40END
 50DEFPROC_ASSEMBLE(A%,B%)
 60LOCAL X%,Y%
 70FOR X%=A% TO A%+5
 80FOR Y%=B% TO B%+15
 90address%=HIMEM+8*X%+640*
    (Y%DIV8)+Y%MOD8
 95?address%=&0F
100NEXT,
110ENDPROC
```

(continued on page 117)

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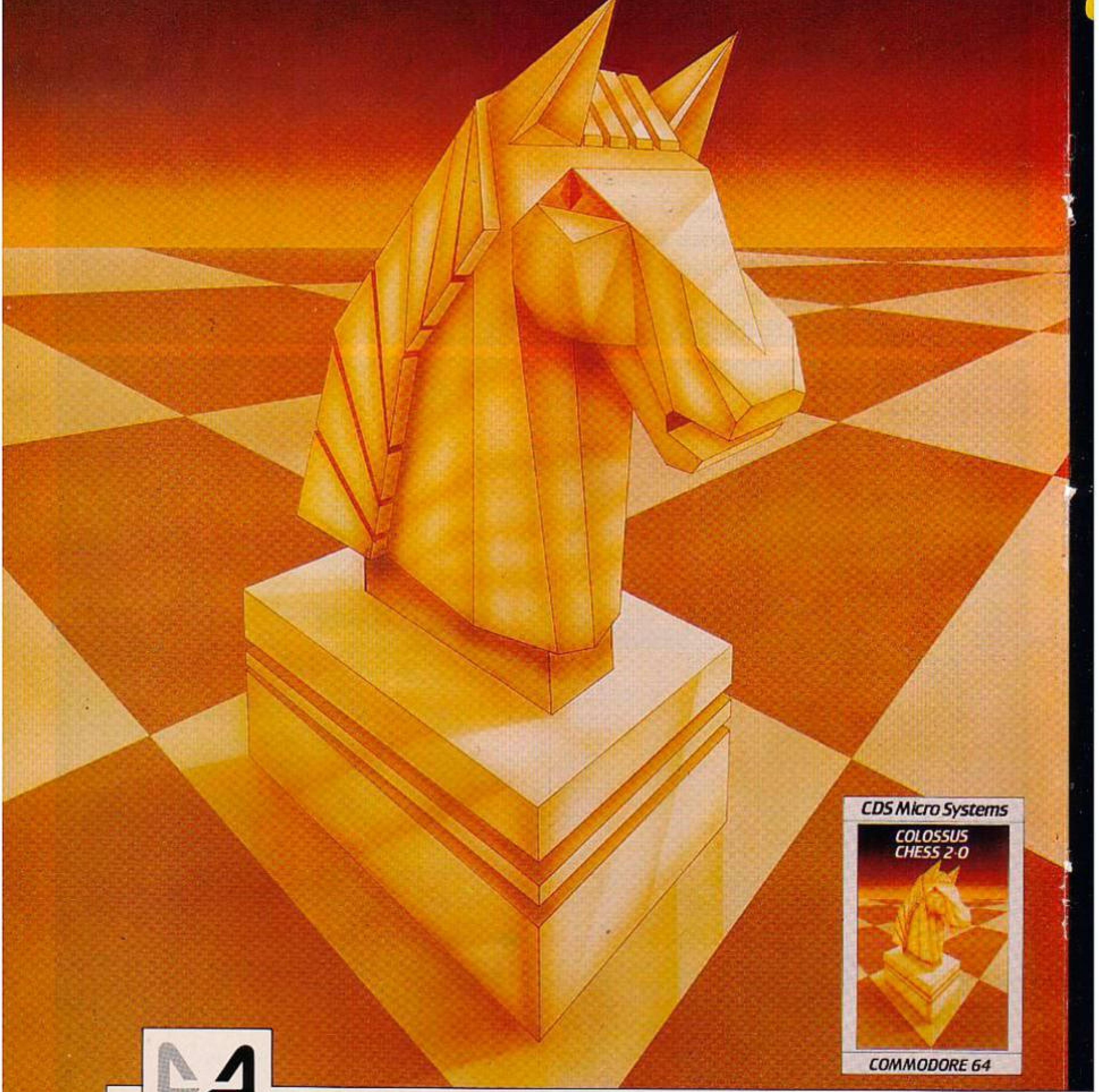
Program 3.

```
 10MODE 2
 20X%=60:Y%=10
 30PROC_ASSEMBLE(X%,Y%)
 40END
 50DEFPROC_ASSEMBLE(A%,B%)
 60LOCAL X%,Y%
 70screen%=HIMEM+640*(B%DIV8)+B%MOD8
 80FOR X%=A% TO A%+5
 90address%=screen%+8*X%
100FOR Y%=0 TO 15
110?address%=&0F
120IF Y%=(7-B%MOD8) OR Y%=(15-B%MOD8)
   address%=address%+633 ELSE address%=
   address%+1
130NEXT,
140ENDPROC
```

Program 4.

```
  10REM *** Sprite example ***
  20MODE 2
  30PROC_ASSEMBLE
  40FOR X%=10 TO 70 STEP 10
  50FOR Y%=10 TO 100 STEP 20
  60CALL sprite,X%,Y%,invader%
  70NEXT,
  80END
  90REM **** Main program ***
1000DEFPROC_ASSEMBLE
1010DIM address% 191,CODE 300
1020DIM invader% 95
1030pointer=&7F:counter=&7C:temp=&01
1040addresslow=&7D:addresshigh=&7E
1050byte=&83
1060FOR N%=0 TO 92 STEP 4
1070READ data
1080!(invader%+N%)=data
1090NEXT
1100FOR PASS=0 TO 2 STEP 2
1110P%=CODE
1120[ OPT PASS
1130.sprite
1140JSR calculate
1150LDY#0
1160LDA &607
1170STA temp
1180LDA &608
1190STA temp+1
1200LDA(temp),Y
1210STA byte
1220INY
1230LDA(temp),Y
1240STA byte+1
1250LDY #0
1260LDX #0
1270STY counter
1280.loop2
1290LDA address%,X
1300STA pointer
1310INX
1320LDA address%,X
1330STA pointer+1
1340LDY counter
1350LDA(byte),Y
1360LDY #0
1370EOR(pointer),Y
1380STA(pointer),Y
1390INC counter
1400INX
1410CPX #192
1420BNE loop2
1430RTS
1440.calculate
1450LDY #0
1460LDA &601
1470STA temp
1480LDA &602
1490STA temp+1
1500LDA(temp),Y
1510STA &70
1520CLC
1530ADC #6
1540STA &74
1550LDA &604
1560STA temp
1570LDA &605
1580STA temp+1
1590LDA(temp),Y
1600STA &71
1610LDA #0
1620STA &79
1630STA &7B
1640STA &73
1650STA addresshigh
1660LDA &71
1670LSR A
1680LSR A
1690LSR A
1700STA &7A
1710ASL A
1720ASL A
1730ASL A
1740STA temp
1750LDA &71
1760SEC
1770SBC temp
1780STA &75
1790STA temp
1800LDA #7
1810SEC
1820SBC temp
1830STA &76
1840LDA #15
1850SEC
1860SBC temp
1870STA &77
1880LDX #7
1890LDA &7A
1900.loop3
1910ASL A
1920ROL &7B
1930DEX
1940BNE loop3
1950STA &78
1960STA &7A
1970LDA &7B
1980STA &79
1990LDA &78
2000ASL A
2010ROL &79
2020ASL A
2030ROL &79
2040CLC
2050ADC &7A
2060BCC over1
2070INC addresshigh
2080CLC
2090.over1
2100ADC &75
2110BCC over2
2120INC addresshigh
2130.over2
2140STA addresslow
2150INX
2160LDA addresshigh
2170ADC &7B
2180CLC
2190ADC &79
2200ADC #&30
2210STA addresshigh
2220LDX#0
2230LDY#2
2240.loop4
2250LDA&70
2260CLC
2270ASL A
2280ROL &73
2290ASL A
2300ROL &73
2310ASL A
2320ROL &73
2330CLC
2340ADC addresslow
2350STA address%,X
2360INX
2370LDA &73
2380ADC addresshigh
2390STA address%,X
2400DEX
2410LDA #0
2420STA counter
2430STA &73
2440.loop5
2450LDA counter
2460CMP &76
2470BEQ over3
2480CMP &77
2490BEQ over3
2500LDA address%,X
2510CLC
2520ADC #&01
2530STA address%,Y
2540INX
2550INY
2560LDA address%,X
2570CLC
2580ADC #&00
2590STA address%,Y
2600JMP over4
2610.over3
2620LDA address%,X
2630CLC
2640ADC #&79
2650STA address%,Y
2660INX
2670INY
2680LDA address%,X
2690ADC #&02
2700STA address%,Y
2710.over4
2720INY
2730INX
2740INC counter
2750LDA counter
2760CMP #16
2770BNE loop5
2780INC &70
2790LDA &70
2800CMP &74
2810BNE loop4
2820RTS
2830]
2840NEXT
2850DATA &00000000,&00000400,&05050000
2860DATA &00050505,&04000000,&0C4D4D0C
2870DATA &111B0E0C,&0A001111,&0C0C5000
2880DATA &0CBEBE0C,&00220C0C,&00220000
2890DATA &0C0B0000,&0C4D4D0C,&11330C0C
2900DATA &00221111,&00000000,&0BBABE08
2910DATA &050F0A08,&0A050505,&00000000
2920DATA &00000000,&00000000,&00000000
2930ENDPROC
```

The CDS experience,



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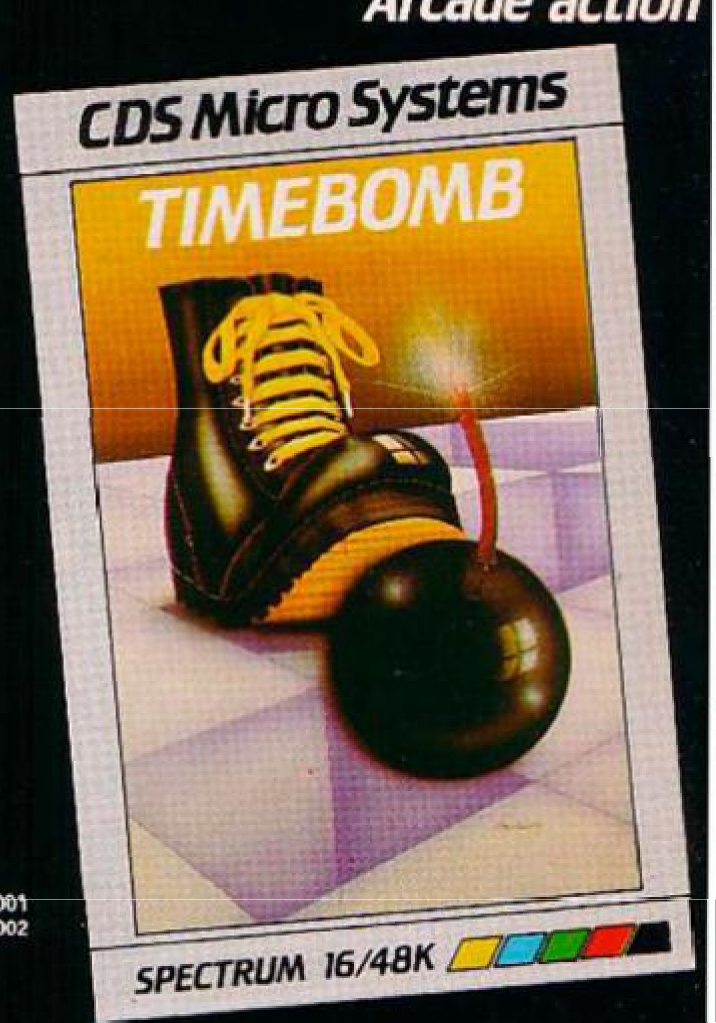

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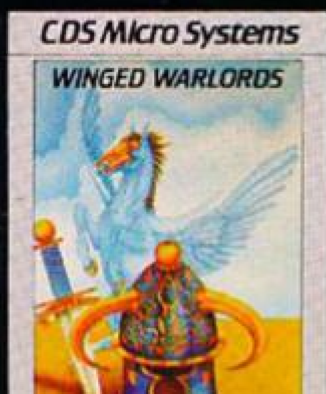

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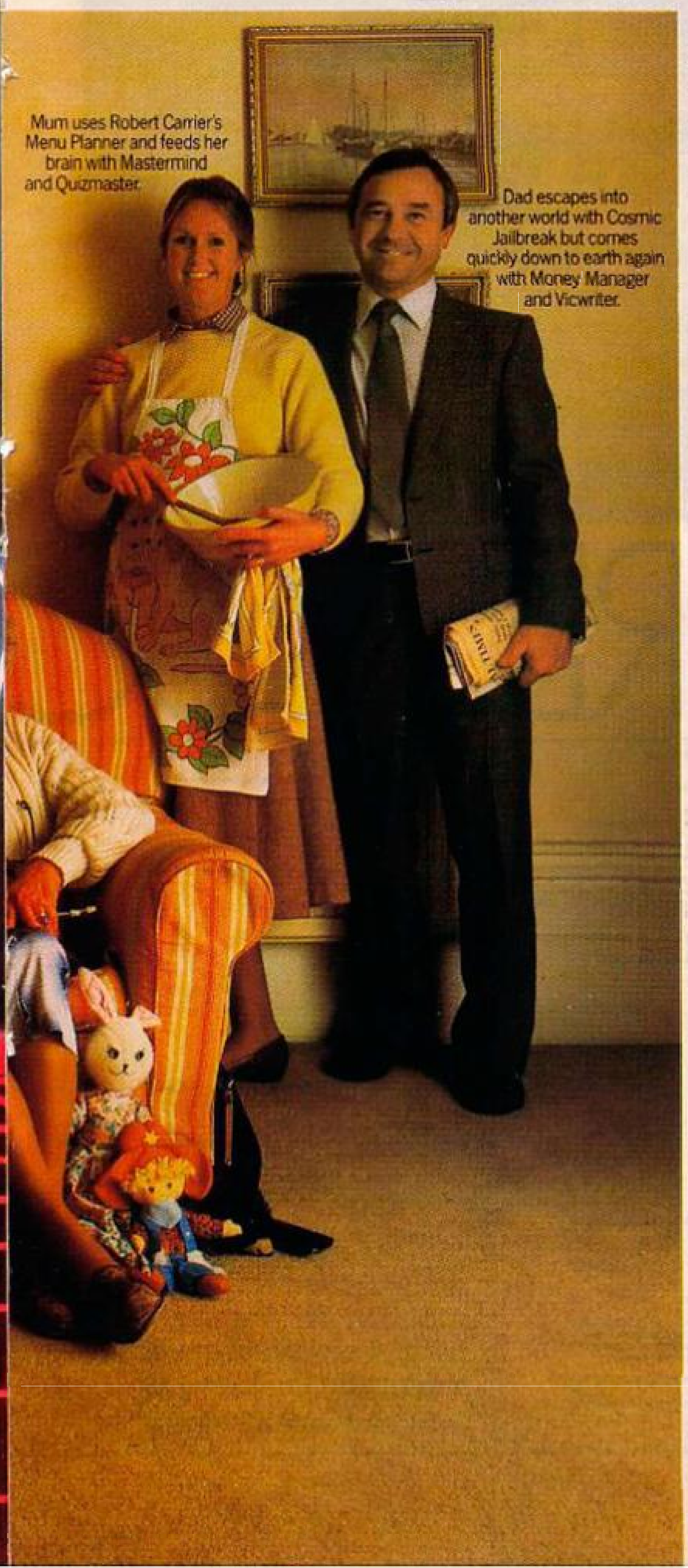

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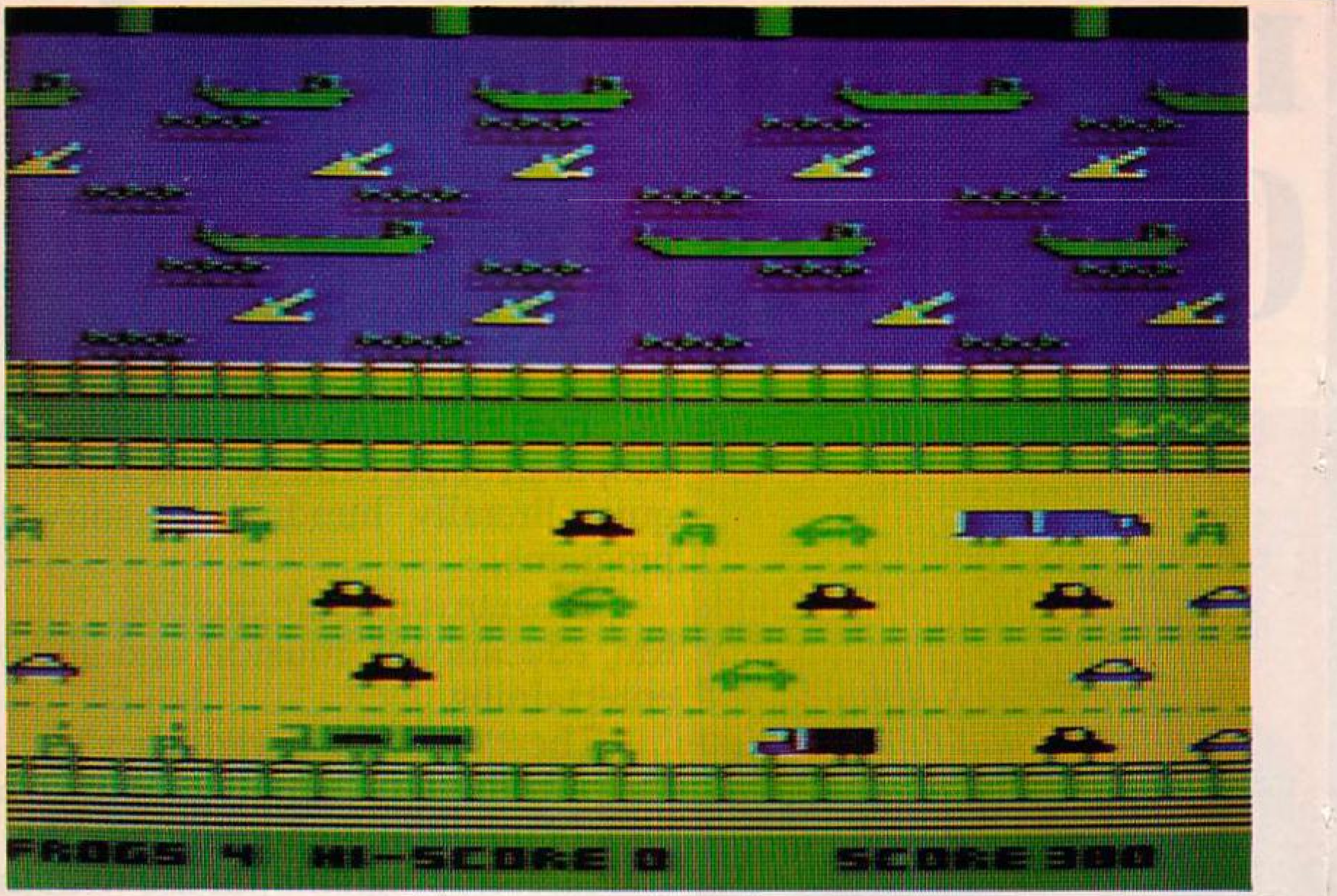


It is possible to get high resolution colour graphics on the Dragon micro. Vince Cockett tells you how.

HI-RES CC

Mode 3 character generator.

```
CHAR GEN 3
10 CLEAR300
20 CLS:PCLS
30 PRINT@228,"INSTRUCTIONS ?  (Y/N)
40 PRINT@0,"      CHARACTER GENERATOR
50 PRINT"      --------------------"
60 PRINT:PRINT"       FOR MODE 3 COLOUR
70 SOUND190,1
80 A$=INKEY$
90 IFA$="Y" THEN120
100 IFA$="N" THENCLS:PRINTSTRING$(255,128);:PRINTSTRIN
G$(97,128);:SOUND190,1:GOTO230
110 GOTO80
120 CLS
130 PRINT"TO MOVE THE CURSOR, USE THE     ARROW KEYS.
 PUT THE CURSOR     OUTSIDE THE GRID WHEN SAVING THECH
ARACTER.
140 PRINT:PRINT"TO COLOUR THE BLOCKS USE THE    PAINT
COMMAND WITH THE ARROW    KEYS."
150 PRINT:PRINT"AUTOMATIC DOUBLE SIZE GRAPHIC   NOTES
ARE IN THE PROGRAM.       HOWEVER, YOU CAN PROGRAM UP
TO  NINE BLOCKS AND BUILD THEM      TOGETHER FOR GREAT
ER RESOLUTION.
160 PRINT@484,"PRESS SPACE TO CONTINUE";
170 SOUND190,1
180 IFINKEY$<>" " THEN 180
190 CLS
200 PRINT"TO USE THE CODES FROM THE        PROGRAM, POK
E THEM INTO THE TOP CORNER OF THE PICTURE AND get    TH
EM FOR USE IN YOUR PROGRAM.
210 PRINT:PRINT"YOU CAN ALSO, USING THE LARGE   GRID,
WORK OUT YOUR CHARACTERS  SO AS TO INCLUDE THEM IN A d
raw STATEMENT AS A STRING.
220 PRINT:PRINT"BINARY OR DECIMAL CODES FROM    OTHER
PROGRAMS CAN BE ENTERED   AND THEN COLOURED TO SUIT.
230 PRINT@417,"";:INPUT"PLEASE SELECT SCREEN COLOUR SE
T (1 OR 0)";CO
240 CO=INT(CO):IFCO<0 ORCO>1 THEN230 ELSESOUND190,1:SC
REEN0,1:FORD=0 TO 200:NEXT
250 PRINT@417,"";:INPUT"PLEASE SELECT BACKGROUND COLOR
 (1 TO 8)  ";BG
260 BG=INT(BG):IFBG<1 ORBG>8 THEN250 ELSE SOUND190,1:S
CREEN0,1:FORD=1 TO 50:NEXT
270 IFBG>4 THENBG=BG-4
280 FG=BG
290 WR=BG-1:IFBG<2 THENWR=1
300 FORT=0 TO 17:PRINT:FORD=0 TO 50:NEXTD,T
310 PRINT@490,"please"CHR$(128);"wait"
320 FORT=0 TO 8:PRINT:FORD=0 TO 50:NEXTD,T
330 DIMC1(16),C2(16),C3(16),C4(16),BL(16),A(2),B(2),C(
2),D(2),E(2),F(2),G(2),H(2),I(2),J(2),GR(300),CA(240),
CB(240),CC(240),CD(240),CE(240),CF(240),CG(240),CH(240
),CI(240),CJ(240),CU(16),X(7)
340 PMODE3
350 PCLS1:GET(0,0)-(22,10),C1,G
360 PCLS2:GET(0,0)-(22,10),C2,G
370 PCLS3:GET(0,0)-(22,10),C3,G
380 PCLS4:GET(0,0)-(22,10),C4,G
390 PCLS BG
400 FORT=0 TO7:POKE1536+(T*64),228:POKE1537+(T*64),57:
POKE1568+(T*64),228:POKE1569+(T*64),57:NEXT
410 GOSUB1770
420 DRAW"BM150,7"+"C"+STR$(WR)
430 FORT=0 TO 4:DRAWN1$(T)+"BR15":NEXT
440 DRAW"BM150,37"
450 FORT=5 TO 9:DRAWN1$(T)+"BR14":NEXT
460 DRAW"BM16,118":FORT=0 TO2:DRAWN1$(T)+"BR12":NEXT
470 DRAW"BM14,134"+N1$(3)+"BR20"+N1$(5)
480 DRAW"BM14,150":FORT=6 TO 8:DRAWN1$(T)+"BR18":NEXT
490 DRAW"BM150,125":A$="S@@TO@SAVE":GOSUB2330
500 DRAW"BM150,135":A$="R@@TO@RECALL":GOSUB2330
510 DRAW"BM150,145":A$="I@@TO@END":GOSUB2330
520 DRAW"BM150,155":A$="I@@TO@INPUT":GOSUB2330
530 DRAW"BM150,165":A$="C@@TO@CLEAR":GOSUB2330
540 DRAW"BM150,175":A$="P@PAINT@COLOR":GOSUB2330
550 GET(0,0)-(15,15),CU,G
560 FORT=0TO96STEP24:LINE(T,0)-(T,96),PSET:LINE(0,T)-(
96,T),PSET:NEXT
570 FORT=12 TO 84STEP24:LINE(0,T)-(96,T),PSET:NEXT
580 LINE(0,191)-(255,192),PSET,B
590 GET(0,0)-(108,108),GR,G
600 PUT(150,10)-(157,17),A,PRESET
610 PUT(170,10)-(177,17),B,PRESET
620 PUT(190,10)-(197,17),C,PRESET
630 PUT(210,10)-(217,17),D,PRESET
640 PUT(230,10)-(237,17),E,PRESET
650 PUT(150,40)-(157,47),F,PRESET
660 PUT(170,40)-(177,47),G,PRESET
670 PUT(190,40)-(197,47),H,PRESET
680 PUT(210,40)-(217,47),I,PRESET
690 PUT(230,40)-(237,47),J,PRESET
700 PUT(23,120)-(30,127),A,PRESET
710 PUT(31,120)-(38,127),B,PRESET
720 PUT(39,120)-(46,127),C,PRESET
730 PUT(23,128)-(30,135),D,PRESET
740 PUT(31,128)-(38,135),E,PRESET
750 PUT(39,128)-(46,135),F,PRESET
760 PUT(23,136)-(30,143),G,PRESET
770 PUT(31,136)-(38,143),H,PRESET
780 PUT(39,136)-(46,143),I,PRESET
790 PMODE3:SCREEN1,CO
800 DRAW"BM10,188":A$="MODE@THREE@CHARACTER@GENERATOR"
:GOSUB2330
810 SOUND190,1
820 VE=1:HO=2
830 GOTO860
840 FG=PPOINT(HO+1,VE+6)
850 IFFG>4 THENFG=FG-4
860 PUT(HO-2,VE-1)-(HO+18,VE+9),CU,PSET
870 IFPEEK(337)=255THEN880 ELSE870
880 IFPEEK(344)=223  ANDHO<96 THENGOSUB 1000:HO=HO+24
890 IFPEEK(343)=223  ANDHO>2 THENGOSUB1000:HO=HO-24
900 IFPEEK(342)=223  ANDVE<96 THENGOSUB1000:VE=VE+12
910 IFPEEK(341)=223  ANDVE>2THENGOSUB1000:VE=VE-12
920 A$=INKEY$
930 IFA$="S" THENSOUND190,1:GOSUB2370:GOSUB1000:GOSUB2
320:GOTO1050
940 IFA$="R" THENSOUND190,1:GOSUB1000:GOSUB1610:GOTO88
0
950 IFA$="E" THENSOUND190,1:GOTO2910
960 IFA$="I" THENSOUND190,1:GOSUB2380
970 IFA$="C" THENSOUND190,1:PUT(0,0)-(108,108),GR,PSET
:GOSUB2370:GOTO790
980 IFA$="P" THENSOUND190,1:GOSUB2860:GOTO870
990 GOTO840
1000 ONFG GOSUB1010,1020,1030,1040:RETURN
1010 PUT(HO,VE)-(HO+22,VE+10),C1,PSET:RETURN
1020 PUT(HO,VE)-(HO+22,VE+10),C2,PSET:RETURN
1030 PUT(HO,VE)-(HO+22,VE+10),C3,PSET:RETURN
1040 PUT(HO,VE)-(HO+22,VE+10),C4,PSET:RETURN
1050 HO=-1:VE=-1
1060 GOSUB2370:DRAW"BM2,187":A$="SELECT@CHARACTER@@@@
@TO@@J":SOUND190,1:GOSUB2330
1070 A$=INKEY$:IFA$="" THEN1070
1080 IFA$<"A" ORA$>"J" THEN1070
1090 D=ASC(A$)-64
1100 SOUND190,1
1110 FORY=9 TO93 STEP12
1120 VE=VE+1:HO=0
1130 J=8
1140 VA=64
1150 FORX=3 TO92 STEP24
1160 J=J-1
1170 HO=HO+2
1180 C=PPOINT(X,Y)
1190 PSET(HO+183,VE+77,C)
1200 IFCO=1 THENC=C-4
1210 V=V+VA*(C-1)
1220 VA=VA/4
1230 NEXTX
1240 DRAW"BM98,"+STR$(Y)+"BR3":GOSUB2340:X(K)=V:K=K+1:
V=0
1250 NEXTY
1260 K=0
1270 GOSUB2370
1280 DRAW"BM2,188":A$="SPACE@TO@CONTINUE@OR@D@TO@DOUBL
E@SIZE":GOSUB2330:SOUND190,1
1290 A$=INKEY$
1300 IFA$=" " THENSOUND190,1:GOSUB2370:GOSUB2320:GOTO1
330
1310 IFA$="D" THENSOUND190,1:GOSUB2370:GOSUB2320:GOTO1
450
1320 GOTO1290
1330 OND GOSUB1350,1360,1370,1380,1390,1400,1410,1420,
1430,1440
1340 PUT(184,77)-(191,84),BL,PRESET:PUT(0,0)-(108,108)
,GR,PSET:GOTO790
1350 GET(184,77)-(191,84),A,G:GET(0,0)-(97,97),CA,G:PU
T(23,120)-(30,127),A,PSET:PUT(150,10)-(157,17),A,PSET:
RETURN
1360 GET(184,77)-(191,84),B,G:GET(0,0)-(97,97),CB,G:PU
T(170,10)-(177,17),B,PSET:PUT(31,120)-(38,127),B,PSET:
RETURN
1370 GET(184,77)-(191,84),C,G:GET(0,0)-(97,97),CC,G:PU
T(190,10)-(197,17),C,PSET:PUT(39,120)-(46,127),C,PSET:
RETURN
1380 GET(184,77)-(191,84),D,G:GET(0,0)-(97,97),CD,G:PU
T(23,128)-(30,135),D,PSET:PUT(210,10)-(217,17),D,PSET:
RETURN
1390 GET(184,77)-(191,84),E,G:GET(0,0)-(97,97),CE,G:PU
T(31,128)-(38,135),E,PSET:PUT(230,10)-(237,17),E,PSET:
RETURN
```

THE DRAGON COMPUTER has a powerful Basic vocubulary but getting detailed graphics as produced by other micros is very laborious if not impossible for many programmers. Character generator programs have appeared in various computer publications to assist in the creation of graphics for programs but generally fall short in their ability to be able to demonstrate the practical application of the results obtained. Moreover they all are only able to provide graphics for the PMode 4 black and white resolution of the Dragon picture.

The difficulty in providng colour graphics for the Dragon is the way the picture or bits are coded. In order to select any of the four colours available in each colour set the Dragon pairs the bytes in each bit as follows:

1 memory byte

1	1	1	0	0	1	0	0

Paired bits

Each paired bit can therefore be coded from value 0 to 3 giving four possible colour choices in the pair. Therefore to manually work out the calculations for the values to be set to colour each memory byte can be very laborious.

The Mode 3 character generator simplifies not only the design of the graphics but also converts the values into "Dragon" Data for direct Poking to the picture.

Additional facilities are provided by both the PMode 3 and PMode 4 generators are listed below:

- Up to 10 separate characters can be designed within the program and displayed at any one time.
- Larger size graphics up to a maximum size of three characters wide by three characters high can be produced.
- Automatic double height characters can be instantly made.
- Decimal code is produced for any graphic drawn.
- All working is done in the Mode 3 or Mode 4 resolution, each program containing its own character set.
- Data input from other sources in either binary or decimal format can be handled.
- In the colour mode there is a full choice of background colours and also a choice of colour sets.

In order to enter the information derived into your own program I have included the game of Frogsy. The game is provided in three programs which have to be joined together once each program has been entered.

)LOUR GRAPHICS

Demonstration program

The demonstration program for graphics is titled Picture — listing 3 — which gives a good visual display of the build up of high-resolution colour picture in Basic.

Basically, what is going on is that each character is being Poked to the top left corner of the picture of the high-resolution screen. The graphic is then copied by the Get command and stored in the computer memory and then can be Put at any position required on the screen.

What has been created is a user defined graphic in line with most other micros.

The Put and Get routines are based on a screen grid similar in a way to using the Dragon print grid. In the program the varibles PX and PY are used to denote the horizontal and vertical positions to place the character. For this purpose the screen has been set with 32 horizontal and 24 vertical positions starting with the position 0 in the left corner.

To assemble the game enter the three programs and save each as a Basic program on a spare tape. Then select your games tape on which to Save the final program and save onto it program 1, the game Basic. Leave the tape where it stops and load into the computer the machine-code Basic program. Re-enter the games tape, select record/play on the cassette and run the machine code program to save a machine-code file to the tape. Repeat the process with the picture program deleting line 1470 to allow the program to save the picture as a machine-code file to the tape.

The game tape now contains the Frogsy Basic program, the machine code scrolling program and the game picture as a machine-code file.

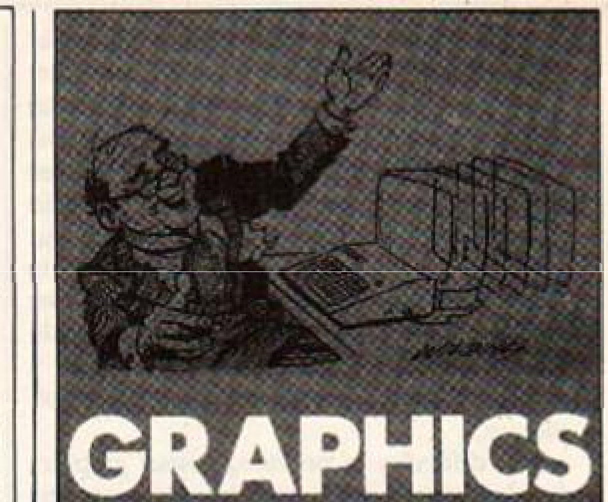
On running the Basic program will automatically load in the machine code information itself.

Finally if anyone would like the Frogsy program on a cassette with machine code music plus the two character generators I will be most please to supply them for £6 plus P&P. For your assessment and combined game demonstration program on side two already includes the machine code. V Cockett, Rue Mahant, St. Saviour, Guernsey.

```
1400 GET(184,77)-(191,84),F,G:GET(0,0)-(97,97),CF,G:PU
T(150,40)-(157,47),F,PSET:PUT(39,128)-(46,135),F,PSET:
RETURN
1410 GET(184,77)-(191,84),G,G:GET(0,0)-(97,97),CG,G:PU
T(170,40)-(177,47),G,PSET:PUT(23,136)-(30,143),G,PSET:
RETURN
1420 GET(184,77)-(191,84),H,G:GET(0,0)-(97,97),CH,G:PU
T(190,40)-(197,47),H,PSET:PUT(31,136)-(38,143),H,PSET:
RETURN
1430 GET(184,77)-(191,84),I,G:GET(0,0)-(97,97),CI,G:PU
T(210,40)-(217,47),I,PSET:PUT(39,136)-(46,143),I,PSET:
RETURN
1440 GET(184,77)-(191,84),J,G:GET(0,0)-(97,97),CJ,G:PU
T(230,40)-(237,47),J,PSET:RETURN
1450 FORX=0 TO 16 STEP4
1460 FORY=0 TO 16 STEP2
1470 C=PPOINT(184+X/2,77+Y/2)
1480 FORT=0 TO1
1490 FORT1=0 TO3
1500 PSET(184+T1+X,87+T+Y,C)
1510 NEXTT1,T
1520 NEXTY,X
1530 FORT1=0 TO 480 STEP32
1540 BD=INT(T1/32)+1
1550 DRAW"BM98,"+STR$(BD*6)
1560 V=PEEK(4343+T1):GOSUB2340:V=PEEK(4344+T1):DRAW"BR
4":GOSUB2340
1570 NEXT
1580 GOSUB2370:DRAW"BM2,188":A$="PRESS@SPACE@TO@CONTIN
UE":GOSUB2330
1590 SOUND190,1
1600 IFINKEY$=" " THENSOUND190,1:GOSUB2370:GOSUB2320:G
OTO1330 ELSE1600
1610 GOSUB2370:DRAW"BM2,188":A$="PLEASE@ENTER@THE@LETT
ER":GOSUB2330
1620 A$=INKEY$:IFA$="" THEN1620
1630 Q=ASC(A$)-64:IFQ<1 ORQ>10 THEN1610
1640 SOUND190,1:GOSUB2370
1650 ONQ GOSUB1670,1680,1690,1700,1710,1720,1730,1740,
1750,1760
1660 PUT(184,77)-(191,84),BL,PRESET:GOSUB2320:GOTO790
1670 PUT(0,0)-(97,97),CA,PSET:RETURN
1680 PUT(0,0)-(97,97),CB,PSET:RETURN
1690 PUT(0,0)-(97,97),CC,PSET:RETURN
1700 PUT(0,0)-(97,97),CD,PSET:RETURN
1710 PUT(0,0)-(97,97),CE,PSET:RETURN
1720 PUT(0,0)-(97,97),CF,PSET:RETURN
1730 PUT(0,0)-(97,97),CG,PSET:RETURN
1740 PUT(0,0)-(97,97),CH,PSET:RETURN
1750 PUT(0,0)-(97,97),CI,PSET:RETURN
1760 PUT(0,0)-(97,97),CJ,PSET:RETURN
1770 DIMAZ$(27):FORT=0TO 27:READAZ$(T):NEXT
1780 DIMN1$(10):FORT=0TO10:READN1$(T):NEXT
1790 DIMN2$(9):FORT=0TO9:READN2$(T):NEXT:RETURN
1800 '
1810 DATABU4R4D2L2R2BR2
1820 DATABR4
1830 DATAU2E2F2NL4D2
1840 DATANR4U2NR2U2R2D2BD2
1850 DATANR4U4R4D8D2D
1860 DATANR4U4R3FD2BD
1870 DATANR4U2NR4U2R4BD4
1880 DATAU2NR4U2R4BD4
1890 DATANR4U4R4BD2D2
1900 DATAU2NR3U2BR4D4
1910 DATABR2NU4BR2
1920 DATABU4NL3R3D4
1930 DATANR4U2NR3NU2R2D2
1940 DATANU4R4
1950 DATAU4F2E2D4
1960 DATAU4F4NU4
1970 DATAU4R4D4NL4
1980 DATAU2NR4U2R4D2BD2
1990 DATAU4R4D3NL2DNL4
2000 DATAU4R4D2L3F2
2010 DATANR4U2L4U2R4BD4
2020 DATABR2U4NL2R2BD4
2030 DATANU4R4NU4
2040 DATABU4D2F2E2U2BD4
2050 DATANU4R2NU4R2NU4
2060 DATANU2R4U2NU2L2R2NU2BD2
2070 DATABU2NU2R4NU2D2
2080 DATAU2R4D2L2U2NL4BD4NL2
2090 '
2100 DATABRU2R3D2NL2R
2110 DATAUSD2R3FD2L2BR4
2120 DATABRU2LR3D2L3BR3
2130 DATABRU2R3NU2D3L3BR4
2140 DATABEU2R2F2L3BR2BR
2150 DATABRU2NL4U2R2FD4BR1
2160 DATABEU2R2FD3L2BU2R3BR2
2170 DATAUSD2R3FD2BR
2180 DATABR4U3BU2UBR3BD5
2190 DATAFREU3BU2UBR2BD5
2200 DATAE2H2E2BD6
2210 '
2220 DATAU4R4D4NL4
2230 DATAXAZ$(10);
2240 DATAXAZ$(27);
2250 DATABU4R4D2NL4D2NL4
2260 DATAXAZ$(26);
2270 DATAXAZ$(20);
2280 DATAU4R4BD2NL4D2NL4
2290 DATABU4R4D4
2300 DATAU2NR4U2R4D4NL4
2310 DATABU2NR4U2R4D4NL4
2320 DRAW"C"+STR$(BG):LINE(98,0)-(146,180),PSET,BF:DRA
W"C"+STR$(WR):RETURN
2330 FORT=1 TO LEN(A$):DRAW "C"+STR$(WR)+AZ$(ASC(MID$(
A$,T,1))-63)+"BR4":NEXTT:RETURN
2340 A$=MID$(STR$(V),2)
2350 IFLEN(A$)<3 THENA$="0"+A$:GOTO2350
2360 FORT=1 TO LEN(A$):DRAWN2$(VAL(MID$(A$,T,1)))+"BR4
":NEXT:RETURN
2370 COLORBG:LINE(1,182)-(254,190),PSET,BF:DRAW"C"+STR
$(WR):RETURN
2380 GOSUB2370:DRAW"BM2,188":A$="ENTER@D@FOR@DECIMAL@B
@FOR@BINARY":GOSUB2330
2390 PUT(0,0)-(108,108),BR,PSET
2400 SOUND190,1
2410 A$=INKEY$:IFA$="" THEN2410
2420 IFA$="C" THENSOUND190,1:PUT(0,0)-(108,108),BR,PSE
T:GOSUB2370:GOTO790
2430 IFA$="B" THENSOUND190,1:GOTO2670
2440 IFA$="D" THENSOUND190,1:GOTO2450:ELSE2380
2450 GOSUB2370
2460 DRAW"BM2,188":A$="ENTER@THREE@DIGIT@NUMBER":GOSUB
2330
2470 FORVE=1 TO 96 STEP12
2480 DRAW"BM200,188"
2490 B$=""
2500 A$=INKEY$
2510 IFA$="C" THENSOUND190,1:PUT(0,0)-(108,108),BR,PSE
T:GOSUB2370:GOTO790
2520 IFA$<"0" ORA$>"9" THEN2500
2530 B$=B$+A$:DRAW"BR4"+N2$(VAL(A$))
2540 IFLEN(B$)=3 THEN2550 ELSE2500
2550 SOUND190,1:V=VAL(B$)
2560 IFV>255 THEN COLORBG:LINE(200,182)-(254,190),PSET
,BF:DRAW"BM200,188:C"+STR$(WR) :GOTO2490
2570 HO=2
2580 FORT1=7 TO 0 STEP-1
2590 IFV<INT(2^T1) THEN PUT(HO,VE)-(HO+9,VE+9),BL,PSET
 ELSEV=V-INT(2^T1):PUT(HO,VE)-(HO+9,VE+9),BL,PRESET
2600 HO=HO+12
2610 NEXTT1
2620 SOUND190,1
2630 COLORBG:LINE(200,182)-(254,190),PSET,BF:COLORWR
2640 NEXTVE
2650 GOSUB2370
2660 GOTO790
2670 GOSUB2370
2680 DRAW"BM2,188":A$="ENTER@BINARY@NUMBER":GOSUB2330
2690 FORVE=2 TO 96 STEP12
2700 DRAW"BM170,188"
2710 FORHO=2 TO 96 STEP12
2720 A$=""
2730 A$=INKEY$
2740 IFA$="C" THENSOUND190,1:PUT(0,0)-(108,108),BR,PSE
T:GOSUB2370:GOTO790
2750 IFA$<"0" ORA$>"1" THEN2730
2760 DRAWN2$(VAL(A$))+"BR4"
2770 IFA$="1" THENPUT(HO,VE)-(HO+9,VE+9),BL,PSET:GOTO2
790
2780 IFA$="0" THENPUT(HO,VE)-(HO+9,VE+9),BL,PRESET:GOT
O2790
2790 NEXTHO
2800 SOUND190,1
2810 FORT=1TO 2000:NEXT
2820 COLORBG:LINE(170,182)-(254,190),PSET,BF:COLORBG-1
2830 NEXTVE
2840 GOSUB2370
2850 GOTO790
2860 GOSUB2370:DRAW"BM5,188":A$="ENTER@PAINT@NUMBER"
:GOSUB2330
2870 FG=VAL(INKEY$):IFFG<1 ORFG>8 THEN2870 ELSE SOUND1
90,1
2880 GOSUB2370
2890 IFFG>4 THENFG=FG-4
2900 RETURN
2910 PRINT"ARE YOU SURE!!!(Y/N)"
2920 IFINKEY$="N" THENGOSUB2370:GOTO790
2930 IFINKEY$="Y" THEN NEW ELSE 2910
```

Mode 4 character generator

```
10 POKE&D495,0
20 DATA0,126,66,90,90,66,126
30 CLS
40 PRINT@228,"INSTRUCTIONS ?  (Y/N)
50 PRINT@0,"     CHARACTER GENERATOR
60 SOUND190,1
70 A$=INKEY$
80 IFA$="Y" THEN110
90 IFA$="N" THENCLS:SOUND190,1:GOTO230
100 GOTO70
110 PRINT:PRINT"TO MOVE THE CURSOR, USE THE      ARROW KEYS.
120 PRINT:PRINT"TO COLOUR THE BLOCKS USE THE     SHIFT + ARROW KEY TOGETHER.
130 PRINT:PRINT"AUTOMATIC DOUBLE SIZE GRAPHIC   NOTES ARE IN THE PROGRAM.        HOWEVER, YOU CAN PROGRAM UP TO  NINE BLOCKS AND BUILD THEM      TOGETHER FOR GREATER RESOLUTION.
140 PRINT@484,"PRESS SPACE TO CONTINUE";
150 SOUND190,1
160 IFINKEY$<>" " THEN 160
170 CLS
180 PRINT"TO USE THE CODES FROM THE       PROGRAM, POKE THEM INTO THE TOP CORNER OF THE PICTURE AND get   THEM FOR USE IN YOUR PROGRAM.
190 PRINT:PRINT"YOU CAN ALSO, USING THE LARGE   GRID, WORK OUT YOUR CHARACTERS  SO AS TO INCLUDE THEM IN A draw STATEMENT AS A STRING.
200 PRINT:PRINT"MOVE THE CURSOR OUT OF THE GRID","BEFORE SAVING THE CHARACTER.
210 PRINT@482,"PRESS SPACE TO CONTINUE";:SOUND190,1
220 IFINKEY$<>" " THEN220 ELSE CLS: SOUND190,1
230 INPUT"BACKGROUND COLOUR (0 OR 1)";CS
240 IFINT(CS)>1 THEN230
250 DIMBL(2),A(2),B(2),C(2),D(2),E(2),F(2),G(2),H(2),I(2),J(2),GR(250),CA(200),CB(200),CC(200),CD(200),CE(200),CF(200),CG(200),CH(200),CI(200),CJ(200),CU(2),X(7)
260 PMODE4:PCLSCS:COLORABS(1-CS),CS
270 PRINT@137,"please";CHR$(128);"wait"
280 FORT=0 TO6:READA:POKE1536+(T*32),255-A:NEXT
290 GOSUB1610
300 DRAW"BM150,7"
310 FORT=0 TO 4:DRAWN1$(T)+"BR15":NEXT
320 DRAW"BM150,37"
330 FORT=5 TO 9:DRAWN1$(T)+"BR14":NEXT
340 DRAW"BM14,118":FORT=0 TO2:DRAWN1$(T)+"BR12":NEXT
350 DRAW"BM14,134"+N1$(3)+"BR30"+N1$(5)
360 DRAW"BM14,150":FORT=6 TO 9:DRAWN1$(T)+"BR12":NEXT
370 DRAW"BM150,125":A$="S@@TO@SAVE":GOSUB2170
380 DRAW"BM150,135":A$="R@@TO@RECALL":GOSUB2170
390 DRAW"BM150,145":A$="E@@TO@END":GOSUB2170
400 DRAW"BM150,155":A$="I@@TO@INPUT@DATA":GOSUB2170
410 DRAW"BM150,165":A$="C@@TO@CLEAR":GOSUB2170
420 GET(0,0)-(7,7),CU,G
430 FORT=0TO88STEP11:LINE(0+T,0)-(0+T,88),PSET:LINE(0,0+T)-(88,0+T),PSET:NEXT
440 LINE(0,181)-(255,192),PSET,B
450 GET(0,0)-(99,99),GR,G
460 PUT(150,10)-(157,17),A,PSET
470 PUT(170,10)-(177,17),B,PSET
480 PUT(190,10)-(197,17),C,PSET
490 PUT(210,10)-(217,17),D,PSET
500 PUT(230,10)-(237,17),E,PSET
510 PUT(150,40)-(157,47),F,PSET
520 PUT(170,40)-(177,47),G,PSET
530 PUT(190,40)-(197,47),H,PSET
540 PUT(210,40)-(217,47),I,PSET
550 PUT(230,40)-(237,47),J,PSET
560 PUT(23,120)-(30,127),A,PSET
570 PUT(31,120)-(38,127),B,PSET
580 PUT(39,120)-(46,127),C,PSET
590 PUT(23,128)-(30,135),D,PSET
600 PUT(31,128)-(38,135),E,PSET
610 PUT(39,128)-(46,135),F,PSET
620 PUT(23,136)-(30,143),G,PSET
630 PUT(31,136)-(38,143),H,PSET
640 PUT(39,136)-(46,143),I,PSET
650 SCREEN1,1
660 DRAW"BM40,188":A$="MODE@FOUR@CHARACTER@GENERATOR":GOSUB2170
670 SOUND190,1
680 VE=1:HO=1
690 '
700 PUT(HO+1,VE+1)-(HO+8,VE+8),CU,PSET
710 IFPEEK(337)<255  THEN720 ELSE710
720 IFPEEK(135)=9 ANDHO<88 THEN ON CS+1 GOSUB 880, 870:HO=HO+11
730 IFPEEK(135)=8 ANDHO>1 THEN ON CS+1 GOSUB 880,870:HO=HO-11
740 IFPEEK(135)=10 ANDVE<88 THEN ON CS+1 GOSUB 880,870:VE=VE+11
750 IFPEEK(135)=94 ANDVE>8 THEN ON CS+1 GOSUB 880,870:VE=VE-11
760 IFPEEK(135)=93 ANDHO<88 THEN ONCS+1 GOSUB870,880:HO=HO+11
770 IFPEEK(135)=21 ANDHO>1 THEN ONCS+1 GOSUB870,880:HO=HO-11
780 IFPEEK(135)=91 ANDVE<88 THEN ON CS+1 GOSUB870,880:VE=VE+11
790 IFPEEK(135)=95 ANDVE>1 THEN ON CS+1 GOSUB870,880:VE=VE-11
800 A$=INKEY$
810 IFA$="S" THENSOUND190,1:GOSUB870:GOTO890
820 IFA$="R" THENSOUND190,1:GOSUB870:GOTO1450
830 IFA$="E" THENSOUND190,1:GOSUB2680
840 IFA$="I" THENSOUND190,1:PUT(0,0)-(99,99),GR,PSET:GOSUB2210:GOTO2220
850 IFA$="C" THENSOUND190,1:PUT(0,0)-(99,99),GR,PSET:GOSUB2210:GOTO660
860 GOTO690
870 PUT(HO,VE)-(HO+9,VE+9),BL,PRESET:RETURN
880 PUT(HO,VE)-(HO+9,VE+9),BL,PSET:RETURN
890 HO=-1:VE=-1
900 GOSUB2210:DRAW"BM2,188";:A$="SELECT@CHARACTER@A@TO@J":GOSUB2170:SOUND190,1
910 GOSUB2160
920 A$=INKEY$:IFA$="" THEN920
930 IFA$< "A" ORA$>"J" THEN920
940 G=ASC(A$)-64
950 SOUND190,1
960 FORY=5 TO82 STEP11
970 VE=VE+1:HO=0
980 J=8
990 FORX=5 TO82 STEP11
1000 J=J-1
1010 HO=HO+1
1020 C=PPOINT(X,Y)
1030 PSET(HO+183,VE+77,C)
1040 IFC=0 THENC=1 ELSEC=0
1050 V=V+C*INT(2^J)
1060 NEXTX
1070 V=V-255
1080 DRAW"BM94,"+STR$(Y)+"BR2":GOSUB2180:X(X)=V:X=X+1:V=0
1090 NEXTY
1100 X=0
1110 GOSUB2210
1120 DRAW"BM2,188":A$="SPACE@TO@CONTINUE@OR@S@FOR@DOUBLE@SIZE":GOSUB2170:SOUND190,1
1130 A$=INKEY$:IFA$="" THEN1130
1140 GOSUB2210
1150 IFA$=" " THENSOUND190,1:GOSUB2160:GOTO1170
1160 IFA$="S" THENSOUND190,1:GOSUB2160:GOTO1290
1170 ONG GOSUB1190,1200,1210,1220,1230,1240,1250,1260,1270,1280
1180 PUT(184,77)-(191,84),BL,PRESET:PUT(0,0)-(99,99),GR,PSET:GOTO650
1190 GET(184,77)-(191,84),A,G:GET(0,0)-(88,88),CA,G:PUT(23,120)-(30,127),A,PSET:PUT(150,10)-(157,17),A,PSET:RETURN
1200 GET(184,77)-(191,84),B,G:GET(0,0)-(88,88),CB,G:PUT(170,10)-(177,17),B,PSET:PUT(31,120)-(38,127),B,PSET:RETURN
1210 GET(184,77)-(191,84),C,G:GET(0,0)-(88,88),CC,G:PUT(190,10)-(197,17),C,PSET:PUT(39,120)-(46,127),C,PSET:RETURN
1220 GET(184,77)-(191,84),D,G:GET(0,0)-(88,88),CD,G:PUT(23,128)-(30,135),D,PSET:PUT(210,10)-(217,17),D,PSET:RETURN
1230 GET(184,77)-(191,84),E,G:GET(0,0)-(88,88),CE,G:PUT(31,128)-(38,135),E,PSET:PUT(230,10)-(237,17),E,PSET:RETURN
1240 GET(184,77)-(191,84),F,G:GET(0,0)-(88,88),CF,G:PUT(150,40)-(157,47),F,PSET:PUT(39,128)-(46,135),F,PSET:RETURN
1250 GET(184,77)-(191,84),G,G:GET(0,0)-(88,88),CG,G:PUT(170,40)-(177,47),G,PSET:PUT(23,136)-(30,143),G,PSET:RETURN
1260 GET(184,77)-(191,84),H,G:GET(0,0)-(88,88),CH,G:PUT(190,40)-(197,47),H,PSET:PUT(31,136)-(38,143),H,PSET:RETURN
1270 GET(184,77)-(191,84),I,G:GET(0,0)-(88,88),CI,G:PUT(210,40)-(217,47),I,PSET:PUT(39,136)-(46,143),I,PSET:RETURN
1280 GET(184,77)-(191,84),J,G:GET(0,0)-(88,88),CJ,G:PUT(230,40)-(237,47),J,PSET:RETURN
1290 FORX=0 TO 16 STEP2
1300 FORY=0 TO 16 STEP2
1310 C=PPOINT(184+X/2,77+Y/2)
1320 FORT=0 TO1
1330 FORT1=0 TO1
1340 PSET(184+T1+X,87+T+Y,C)
1350 NEXTT1,T
1360 NEXTY,X
1370 FORT1=0 TO 480 STEP32
1380 DO=INT(T1/32)*11
1390 DRAW"BM94,"+STR$(DO+4)
1400 V=255-PEEK(4343+T1):GOSUB2180:V=255-PEEK(4344+T1):DRAW"BR6":GOSUB2180
1410 NEXT
1420 GOSUB2210:DRAW"BM2,188":A$="PRESS@SPACE@TO@CONTINUE":GOSUB2170
1430 SOUND190,1
1440 IFINKEY$=" " THENSOUND190,1:GOSUB2210:GOSUB2160:GOTO1170 ELSE1440
1450 GOSUB2210:DRAW"BM2,188":A$="PLEASE@ENTER@THE@LETTER":GOSUB2170
1460 A$=INKEY$:IFA$=""  THEN1460
1470 Q=ASC(A$)-64:IFQ<1 ORQ>10 THEN1450
1480 SOUND190,1:GOSUB2210
1490 ONQ GOSUB1510,1520,1530,1540,1550,1560,1570,1580,1590,1600
1500 PUT(184,77)-(191,84),BL,PRESET:GOSUB2160:GOTO650
1510 PUT(0,0)-(88,88),CA,PSET:RETURN
1520 PUT(0,0)-(88,88),CB,PSET:RETURN
1530 PUT(0,0)-(88,88),CC,PSET:RETURN
1540 PUT(0,0)-(88,88),CD,PSET:RETURN
1550 PUT(0,0)-(88,88),CE,PSET:RETURN
1560 PUT(0,0)-(88,88),CF,PSET:RETURN
1570 PUT(0,0)-(88,88),CG,PSET:RETURN
1580 PUT(0,0)-(88,88),CH,PSET:RETURN
1590 PUT(0,0)-(88,88),CI,PSET:RETURN
1600 PUT(0,0)-(88,88),CJ,PSET:RETURN
1610 DIMAZ$(27):FORT=0TO 27:READAZ$(T):NEXT
1620 DIMN1$(10):FORT=0TO10:READN1$(T):NEXT
1630 DIMN2$(9):FORT=0TO9:READN2$(T):NEXT:RETURN
1640 '
1650 DATABU4R4D2L2D2BR2
1660 DATABR4
1670 DATANRU4R4D5NL3D
1680 DATANR4UNRUNR2U2R3D2RD2
1690 DATANR4UNRUNRU2R4DBD2D
1700 DATANR2NU2LU4R3FD2BD
1710 DATANR4UNRUNR4U2R4BD4
1720 DATANRNLU2NR4U2R4BD4
1730 DATANRNR3NU2LU4R4BD2D2
1740 DATANRNLU2NR3U2BR4D4
1750 DATABR2NU2NNU4BR
1760 DATARR2NU2RU4NL3RBD4
1770 DATANU4RU2R2NU2RD2
1780 DATANU4RNU2R3
1790 DATAU4R2ND3R2D4
1800 DATAU4RF3NU3E
1810 DATARNU2LU4R4D4NL4
1820 DATANRUNR4U2R4D3BD
1830 DATAU4R4D2NL2DNL4
1840 DATARNU2LU4R4D2L2F2
1850 DATAR3NU2U2L4U2R4BD4
1860 DATABR3NU2LU4NL3R2BD4
1870 DATANU4RNU2R3NU4
1880 DATAU4RD2BD2NEUEUBD4
1890 DATANU4R2NU4R2NU4
1900 DATANU2RU2NU2R2NU2RD2
1910 DATABU2U2RD2R3NU2D2
1920 DATAU2RND2R3U2NL4BD4NL2
1930 '
1940 DATABRU2R3D3NL3R
1950 DATAU3D2R3FD6L2BR4
1960 DATABRU2R3BD3L3BR2
1970 DATABRU2R3NU2D3L3BR4
1980 DATABEU2E2R2F2DL3DF2BR
1990 DATABR2U3NLNRU2ERFBD4BR1
2000 DATABEUER2FD2L2BU2F2BR2
2010 DATAUBE2R3FD2BR
2020 DATABR4U3NU3UBR3BD5
2030 DATAFREU3NU3UBR2BD5
2040 DATAE2H2E2BD6
2050 '
2060 DATAXAZ$(16);
2070 DATAXAZ$(10);
2080 DATAXAZ$(27);
2090 DATABU4R4D2NL4DNL3NL4
2100 DATAXAZ$(26);
2110 DATAXAZ$(20);
2120 DATAUNRU3R4BD2NL4D2NL4
2130 DATABU4R4D4LNU2R
2140 DATAUNRUNR4U2R4D4NL4
2150 DATABU2NR4UNRU4D4NL4
2160 COLORCS:LINE(92,0)-(140,180),PSET,BF:COLORABS(1-CS):RETURN
2170 FORT=1 TO LEN(A$):DRAW AZ$(ASC(MID$(A$,T,1))-63)+"BR2":NEXTT:RETURN
2180 A$=MID$(STR$(V),2)
2190 IFLEN(A$)<3 THENA$="0"+A$:GOTO2190
2200 FORT=1 TO LEN(A$):DRAWN2$(VAL(MID$(A$,T,1)))+"BR2":NEXT:RETURN
2210 COLORCS:LINE(1,182)-(254,190),PSET,BF:COLORABS(CS-1):RETURN
2220 GOSUB2210:DRAW"BM2,188":A$="ENTER@@D@@FOR@DECIMAL@@B@@FOR@BINARY":GOSUB2170
2230 SOUND190,1
2240 A$=INKEY$:IFA$="" THEN2240
2250 GOSUB2160
2260 IFA$="B" THENSOUND190,1:GOTO2500
2270 IFA$="D" THENSOUND190,1:GOTO2280:ELSE2220
2280 GOSUB2210
2290 DRAW"BM2,188":A$="ENTER@THREE@DIGIT@NUMBER":GOSUB2170
2300 FORVE=1 TO 88 STEP11
2310 DRAW"BM150,188"
2320 B$=""
2330 A$=INKEY$
2340 IFA$="C" THENPUT(0,0)-(99,99),GR,PSET:GOSUB2210:GOSUB2160:GOTO660
2350 IFA$<"0" ORA$>"9" THEN2330
2360 B$=B$+A$:DRAW"BR4"+N2$(VAL(A$))
2370 IFLEN(B$)=3 THEN2380 ELSE2330
2380 SOUND190,1:V=VAL(B$)
2390 IFV>255 THENLINE(149,182)-(254,190),PRESET,BF:DRAW"BM150,188":GOTO2320
2400 HO=1
2410 FORT1=7 TO 0 STEP-1
2420 IFV<INT(2^T1) THENPUT(HO,VE)-(HO+9,VE+9),BL,PSET ELSEV=V-INT(2^T1):PUT(HO,VE)-(HO+9,VE+9),BL,PRESET
2430 HO=HO+11
2440 NEXTT1
2450 SOUND190,1
2460 LINE(149,182)-(254,190),PRESET,BF
2470 NEXTVE
2480 GOSUB2210
2490 GOTO650
2500 GOSUB2210
2510 DRAW"BM2,188":A$="ENTER@BINARY@NUMBER":GOSUB2170
2520 FORVE=1 TO 88 STEP11
2530 DRAW"BM150,188"
2540 FORHO=1 TO 88 STEP11
2550 A$=""
2560 A$=INKEY$
2570 IFA$="C" THENPUT(0,0)-(99,99),GR,PSET:GOSUB2210:GOSUB2160:GOTO660
2580 IFA$<"0" ORA$>"1" THEN2560
2590 DRAWN2$(VAL(A$))+"BR2"
2600 IFA$="1" THENPUT(HO,VE)-(HO+9,VE+9),BL,PRESET:GOTO2620
2610 IFA$="0" THENPUT(HO,VE)-(HO+9,VE+9),BL,PSET:GOTO2620
2620 NEXTHO
2630 SOUND190,1:FORT=1TO 2000:NEXT
2640 LINE(149,182)-(254,190),PRESET,BF
2650 NEXTVE
2660 GOSUB2210
2670 GOTO650
2680 PRINT"ARE YOU SURE (Y/N)
2690 B$=INKEY$:IFB$="N" THEN SCREEN1,1:RETURN
2700 IFB$="Y" THEN NEW ELSE2690
```

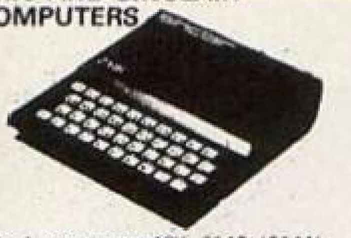


Program 1: Frogsy Basic.

```
10 PCLEAR8
20 GOSUB980
30 PRINT@484,"select"CHR$(128);CHR$(128);"play"CHR$(128);CHR$(128);"on"CHR$(128);CHR$(128);"cassette";
40 SCREEN0,1
50 FORT=1 TO1000:NEXT
60 CLOADM:CLOADM
70 PMODE3
80 DATA1,3,3,3,3,1,1,2,2,2,2,2
90 GOSUB990
100 HS=0:ST=1:GOSUB760
110 A$=INKEY$:IFA$="J" THENGA=1:GOTO140
120 IFA$="K" THENGA=2 :GOTO150
130 GOTO110
140 PRINT@398,"MIND THE TRAFFIC!"USE LEFT / RIGHT TO MOVE ACROSS & "FIRE" TO JUMP FORWARDS.":SCREEN0,1:GOTO160
150 PRINT@398,"MIND THE TRAFFIC!"USE LEFT / RIGHT ARROWS TO MOVE ACROSS AND ^ TO JUMP.":SCREEN0,1
160 PRINT@484,"enter"CHR$(128)"colour"CHR$(128)"set"CHR$(128)"0"CHR$(128)"or"CHR$(128)"1"STRING$(4,128):SCREEN0,1
170 A$=INKEY$:IFA$="" ORA$<"0" ORA$>"1" THEN170
180 CO=VAL(A$)
190 DIMA(22)
200 FORG=0 TO 22 STEP2:READA:A(G)=A+(4*CO):NEXT
210 DIMFR(4),BL(4),PX(40),PY(40)
220 HS=0
230 GOTO320
240 GET(PX*8,PY*8)-((PX*8)+7,(PY*8)+7),BL,G
250 PUT(PX*8,PY*8)-((PX*8)+7,(PY*8)+7),FR,PSET
260 FORD=1 TO 5:NEXT
270 PUT(PX*8,PY*8)-((PX*8)+7,(PY*8)+7),BL,PSET
280 RETURN
290 GET(PX*8,PY*8)-((PX*8)+7,PY*8+7),FR,G
300 GET((PX-1)*8,PY*8)-(((PX-1)*8)+7,PY*8+7),BL,G
310 RETURN
320 DIMN$(9):FORT=0 TO 9:READN$(T):NEXT
330 FR=9:WI=0:SC=0:TI=0:DI=57
340 SCREEN1,CO
350 FORT=1 TO 4:PCOPYT+4 TO T:NEXT
360 IFWI=4 THENFORT=1 TO 10:PLAY"T255ABCDEFG":NEXT:TI=TI+1:WI=0:DI=ABS(DI-75):POKE&HFFFS,DI
370 FORS=0 TO TI:GOSUB960:NEXT
380 IFWI)0 THENGOSUB940
390 PY=22:PX=16:A(11)=1+(4*CO)
400 GOSUB290
410 A$=STR$(FR):DRAW"BM46,192":GOSUB910
420 A$=STR$(SC):DRAW"BM210,192":GOSUB910
430 A$=STR$(HS):DRAW"BM128,192":GOSUB910
440 IFFR=0 THEN700
450 B=0
460 GOSUB270
470 FORT=0 TO INT(TI/2):EXEC2000:NEXT
480 IFGA=1 THEN500
490 GOTO540
500 L=JOYSTK(0)
510 IFL<10 THENPX=PX-1:PLAY"T255O3B8":IFPX<0 THEN650
520 IFL>50 THENPX=PX+1:PLAY"T255O3B8":IFPX>31 THEN650
530 IFPEEK(65280)=254 ORPEEK(65280)=126THENPY=PY-2+(PY=14)+(PY=11):PLAY"T255O2CDEFGAB03G":IFPY<0 THEN650
540 IFGA=1 THEN570
550 I$=INKEY$:IFI$=CHR$(94) THEN PY=PY-2+(PY=14)+(PY=11):PLAY"T255O2CDEFGAB03G":C$="":IFPY<0 THEN650
560 IFPEEK(343)=223 THENPX=PX-1:PLAY"T255O3B8":IFPX<0 THEN650
570 IFPEEK(344)=223 THENPX=PX+1:PLAY"T255O3B8":IFPX>31 THEN650
580 GOSUB240
590 IFPY=22 THEN620
```

(Program 1 continued on page 126)

ORIC AND SINCLAIR COMPUTERS



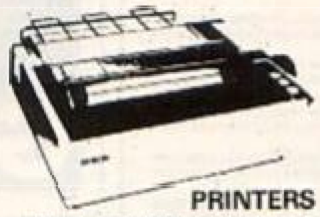
Oric 1 computers 48K £143 (£141) £151. Oric colour printer. Oric colour printer £134 (£123) £140. Sinclair Spectrum 48K £131 (£131) £143. Spectrum 16K £101 (£105) £117. Microdrive £70 (£65) £75. RS232 interface £70 (£65) £75. Blank microdrive cartridges £8 (£8) £9. 32K memory upgrade kit for 16K Spectrum (issue 2 and 3 only) £31 (£28) £30. Fuller Master Unit for the Spectrum including speech unit, sound synthesizer, amplifier and joystick port £56 (£56) £62. Fuller full sized FDS keyboard for the Spectrum with proper space bar £52 (£52) £62. Spectrum printer interfaces with cables:– Centronics £57 (£53) £58. RS232 £35 (£33) £38. ZX printer with 5 free rolls paper £41 (£46) £56. ZX printer alone £36 (£38) £50. 5 printer rolls £13 (£16) £21. ZX81 computer £45 (£44) £54. ZX81 16K ram packs £31 (£28) £30.

COMMODORE COMPUTERS

Commodore 64 £204 (£184) £204. Vic 20 £104 (£97) £117. Convertor to allow most ordinary mono cassette recorders to be used with the Vic 20 and Commodore 64 £10.95 (£11) £13. Bargain package:– cassette convertor + compatible cassette recorder £37 (£38) £44. Commodore cassette recorder £43 (£44) £50. Centronics printer interfaces:– for Vic-20 £42 (£41) £46. for Commodore 64 £45 (£44) £50. 1541 Disc drives £233 (£209) £234. 1525 Printer £235 (£220) £245. 1526 Printer £350 (£330) £360.

ACORN COMPUTERS

Electron £203 (£209) £229. BBC Model B £404 (£378) £408. 14" Colour monitor £228 (£229) £319. Kenda double density disk interface system for beeb £139 (£125) £135. We stok the whole range of Cumana disc drives for the beeb e.g. 100K single £230 (£220) £240. Double 2 × 400K £625 (£560) £580.



PRINTERS

Epson RX80 £306 (£271) £302. Epson RS80F/T £346 (£316) £346. Shinwa CTI CP80 £225 (£218) £248. Epson FX80 £440 (£408) £438. Epson MX100/3 £494 (£465) £495. Oki Microline 80 £213 (£197) £238. Oki Microline 84 £831. The Ultra 21 combined daisy wheel and electric typewriter £438 (£415) £445. The brother EP22 combined matrix pritner and electic typewriter £173 (£166) £186. Juki 6100 proportional daisy wheel printer £423 (£404) £434. MCP40 colour printer £134 (£123) £140. Star STX80 thermal printer £158 (£143) £163. Interfaces to run the above printers from Commodore machines:– Vic-20 £42 (£41) £46. Commodore 64 £45 (£44) £50. We can supply interfaces to run the above printers from Sharp computers £58 (£52) £55.

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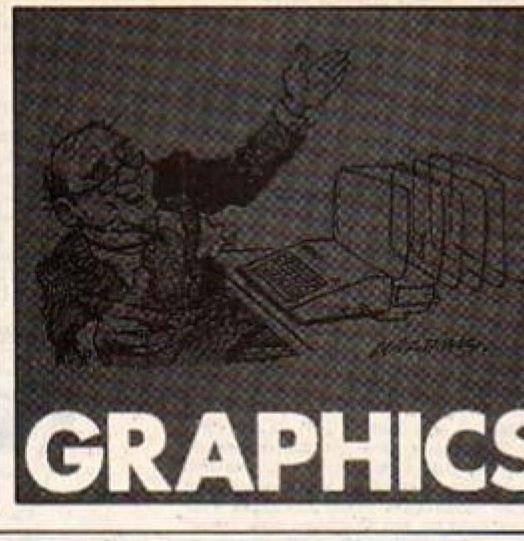
(Program 1 continued from page 124)

```
600 IFPPOINT(PX*8+4,PY*8+5)<>A(PY) THEN650
610 IFPY=0 THENMI=MI+1:FR=FR+1:PX(MI)=PX:PY(MI)=PY:PLA
Y"T255CBCBCBCB":GOTO670
620 IFG=1 THENG=0:GOTO640
630 G=1:GOTO480
640 GOTO460
650 POKE135,0
660 PLAY"O1CFCFCFCFCFC"
670 SC=SC+(200-PY*10)+(PY=0)*-50)+10
680 FR=FR-1:IFFR=0 THENIFHS<SC THENHS=SC
690 GOTO350
700 A=2:B=6
710 FORT=1 TO 70
720 A=ABS(A-B)
730 COLORA
740 LINE(128-T,86-T/4)-(128+T,86+T/4),PSET,B
750 NEXT
760 PLAY"L4O3T5;BCDEL2FL4ECL2DF255DL4EL1C
770 IFST=1 THENST=0:RETURN
780 DRAW"BM40,90;C5;U4R4D2NL4BD2BR4U4R3F2NL4BE2BR4NR4U2
NR4U2R4BD4BR4R4U2L4U2R4BD4BR4R4U2L4U2R4BD4BR8R4U2L4U2R
4BD4BR4U4R4D2NL4BD2BR4U2NR4E2F2D2BR4NR4U4R4BD4BR4NR4U2
NR4U2NR4BD4BR12U4L2R4BD4BR4NR4U4R4D4BR8U4R4D2NL4BD2BR4
NU4R4BR4U2NR4E2F2D2BR4U2NR4E2
790 IFINKEY$<>" " THEN790
800 GOTO330
810 DATANR4U4R4D4
820 DATABR2NU4BR2
830 DATABU4R4D2L4D2R4
840 DATABU4R4D2NL4D2NL4
850 DATABU2NU2R4NU2NE2BD2
860 DATAR4U2L4U2R4BD4
870 DATAU4R4D2NL4D2NL4
880 DATABU4R4D2BR3.
890 DATANR4U4R4D2NL4D2
900 DATAR4U2L4U2R4D4
910 FORT=2 TO LEN(A$)
920 DRAW"CB"+N$(VAL(MID$(A$,T,1)))+"BR4"
930 NEXT:RETURN
940 FORT=1 TO MI:PUT(PX(T)*8,PY(T)*8)-(PX(T)*8+7,PY(T)
*8+7),FR,PSET:NEXT
950 RETURN
960 DRAW"BM"+STR$(RND(200))+",95;C"+STR$(G+2)+"U3R2D3EU
HL2D2NL2R4E2R2F3R2E3R2F3R2E3R2F3R2
970 RETURN
980 CLS0
990 PRINT@100,CHR$(129);CHR$(140)CHR$(130)CHR$(129)CHR
$(140)CHR$(130);
1000 PRINT@132,STRING$(6,CHR$(143));
1010 PRINT@163,CHR$(129)CHR$(135)CHR$(140)CHR$(143)CHR
$(143)CHR$(140)CHR$(139)CHR$(130);
1020 PRINT@194,CHR$(129)CHR$(140)CHR$(135+48)CHR$(191)
CHR$(191)CHR$(191)CHR$(191)CHR$(139+48)CHR$(140)CHR$(1
30);
1030 PRINT@225,CHR$(129)CHR$(135)CHR$(130)CHR$(191)CHR
$(129)CHR$(191)CHR$(191)CHR$(130)CHR$(191)CHR$(129)CHR
$(139)CHR$(130);
1040 PRINT@257,CHR$(143)CHR$(139)CHR$(137)CHR$(188)CHR
$(134)CHR$(191)CHR$(191)CHR$(137)CHR$(188)CHR$(134)CHR
$(135)CHR$(143);
1050 PRINT@289,CHR$(133)CHR$(143)CHR$(141)CHR$(143)CHR
$(130)CHR$(189)CHR$(190)CHR$(129)CHR$(143)CHR$(142)CHR
$(143)CHR$(138);
1060 PRINT@320,CHR$(131)CHR$(135)CHR$(143)CHR$(128)CHR
$(141)CHR$(142)CHR$(140)CHR$(140)CHR$(141)CHR$(142)CHR
$(128)CHR$(143)CHR$(139)CHR$(131);
1070 PRINT@352,CHR$(132)CHR$(142)CHR$(136)CHR$(128)CHR
$(132)CHR$(142)CHR$(130)CHR$(129)CHR$(141)CHR$(136)CHR
$(128)CHR$(132)CHR$(141)CHR$(136);
1080 PRINT@110,CHR$(158)CHR$(156)CHR$(152)CHR$(158)CHR
$(156)CHR$(146)CHR$(150)CHR$(156)CHR$(146)CHR$(150)CHR
$(136)CHR$(152)CHR$(150)CHR$(156)CHR$(157)CHR$(154)CHR
$(128)CHR$(154);
1090 PRINT@142,CHR$(158)CHR$(156)CHR$(128)CHR$(158)CHR
$(157)CHR$(128)CHR$(154)CHR$(128)CHR$(154)CHR$(154)CHR
$(148)CHR$(154)CHR$(148)CHR$(156)CHR$(146)CHR$(148)CHR
$(158);
1100 PRINT@174,CHR$(152)CHR$(128)CHR$(128)CHR$(152)CHR
$(128)CHR$(152)CHR$(148)CHR$(156)CHR$(128)CHR$(148)CHR
$(156)CHR$(128)CHR$(148)CHR$(156)CHR$(128)CHR$(128)CHR
$(152);
1110 PRINT@1,"please"CHR$(128)"help"CHR$(128)"me"CHR$(
128)"home";
1120 PRINT@241,"DRAGON 32K";
1130 PRINT@404,"enter"CHR$(128)"Joystick"CHR$(128)"or"
CHR$(128)"Keyboard"CHR$(128);
1140 SCREEN0,1
1150 RETURN
```



Program 2: Frogsy machine-code loader.

```
10 DATABE,08,00,10,8E,03,00,A6,84,A7,A0,30,88,20,8C,09
,00,26,F4,8E,08,01,A6,84,A7,1F,30,01,8C,09,00,26,F5,8E
,08,FF,10,8E,03,08,A6,A2,A7,84,30,88,E0,8C,07,FF,26,F4
20 DATABE,0A,1F,10,8E,03,00,A6,84,A7,A0,30,88,20,8C,0B
,1F,26,F4,8E,0A,FE,A6,84,A7,01,30,1F,8C,09,E0,26,F5,8E
,0A,E0,10,8E,03,08,A6,A2,A7,84,30,88,E0,8C,09,E0,26,F4
30 DATABE,0C,00,10,8E,03,00,A6,84,A7,A0,30,88,20,8C,0D
,00,26,F4,8E,0C,01,A6,84,A7,1F,30,01,8C,0D,00,26,F5,8E
,0C,FF,10,8E,03,08,A6,A2,A7,84,30,88,E0,8C,0B,FF,26,F4
40 DATABE,0E,1F,10,8E,03,00,A6,84,A7,A0,30,88,20,8C,0F
,1F,26,F4,8E,0E,FE,A6,84,A7,01,30,1F,8C,0D,E0,26,F5,8E
,0E,E0,10,8E,03,08,A6,A2,A7,84,30,88,E0,8C,0D,E0,26,F4
50 DATABE,11,00,10,8E,03,00,A6,84,A7,A0,30,88,20,8C,12
,00,26,F4,8E,11,01,A6,84,A7,1F,30,01,8C,12,00,26,F5,8E
,11,FF,10,8E,03,08,A6,A2,A7,84,30,88,E0,8C,10,FF,26,F4
60 DATABE,14,1F,10,8E,03,00,A6,84,A7,A0,30,88,20,8C,15
,1F,26,F4,8E,14,FE,A6,84,A7,01,30,1F,8C,13,E0,26,F5,8E
,14,E0,10,8E,03,08,A6,A2,A7,84,30,88,E0,8C,13,E0,26,F4
70 DATABE,16,1F,10,8E,03,00,A6,84,A7,A0,30,88,20,8C,17
,1F,26,F4,8E,16,FE,A6,84,A7,01,30,1F,8C,15,E0,26,F5,8E
,16,E0,10,8E,03,08,A6,A2,A7,84,30,88,E0,8C,15,E0,26,F4
80 DATABE,18,00,10,8E,03,00,A6,84,A7,A0,30,88,20,8C,19
,00,26,F4,8E,18,01,A6,84,A7,1F,30,01,8C,19,00,26,F5,8E
,18,FF,10,8E,03,08,A6,A2,A7,84,30,88,E0,8C,17,FF,26,F4
90 DATABE,1A,00,10,8E,03,00,A6,84,A7,A0,30,88,20,8C,1B
,00,26,F4,8E,1A,01,A6,84,A7,1F,30,01,8C,1B,00,26,F5,8E
,1A,FF,10,8E,03,08,A6,A2,A7,84,30,88,E0,8C,19,FF,26,F4
,39
100 DATABE,0A,1F,10,8E,03,00,A6,84,A7,A0,30,88,20,8C,0
B,1F,26,F4,8E,0A,FE,A6,84,A7,01,30,1F,8C,09,E0,26,F5,8
E,0A,E0,10,8E,03,08,A6,A2,A7,84,30,88,E0,8C,09,E0,26,F
4
110 DATABE,0C,00,10,8E,03,00,A6,84,A7,A0,30,88,20,8C,0
D,00,26,F4,8E,0C,01,A6,84,A7,1F,30,01,8C,0D,00,26,F5,8
E,0C,FF,10,8E,03,08,A6,A2,A7,84,30,88,E0,8C,0B,FF,26,F
4
120 DATABE,11,00,10,8E,03,00,A6,84,A7,A0,30,88,20,8C,1
2,00,26,F4,8E,11,01,A6,84,A7,1F,30,01,8C,12,00,26,F5,8
E,11,FF,10,8E,03,08,A6,A2,A7,84,30,88,E0,8C,10,FF,26,F
4
130 DATABE,16,1F,10,8E,03,00,A6,84,A7,A0,30,88,20,8C,1
7,1F,26,F4,8E,16,FE,A6,84,A7,01,30,1F,8C,15,E0,26,F5,8
E,16,E0,10,8E,03,08,A6,A2,A7,84,30,88,E0,8C,15,E0,26,F
4
140 DATABE,18,00,10,8E,03,00,A6,84,A7,A0,30,88,20,8C,1
9,00,26,F4,8E,18,01,A6,84,A7,1F,30,01,8C,19,00,26,F5,8
E,18,FF,10,8E,03,08,A6,A2,A7,84,30,88,E0,8C,17,FF,26,F
4,39,END
150 T=20001
160 READA$
170 IFA$="END" THEN210
180 A=A+VAL("&H"+A$)
190 POKET,VAL("&H"+A$)
200 T=T+1:GOTO160
210 IFA=73776 THEN 220 ELSEPRINT"program error":END
220 CSAVEM"M/CODE",20001,20731,730
```

Picture program.

```
10 PCLEAR8
20 PMODE3:SCREEN1,1
30 DIMC2(4),C1(3),BL(8)
40 PCLS6
50 COLOR7
60 LINE(0,0)-(255,80),PSET,BF
70 COLOR5
80 LINE(0,(23*8))-(255,(24*8)),PSET,BF
90 FORT=168 TO 182 STEP2
100 COLOR8
110 LINE(0,T)-(255,T),PSET
120 COLOR6
130 LINE(0,T+1)-(255,T+1),PSET
140 NEXTT
150 FORT=80 TO 102 STEP2
160 COLOR6
170 LINE(0,T)-(255,T),PSET
180 COLOR8
190 LINE(0,T+1)-(255,T+1),PSET
200 NEXT
210 COLOR5
220 LINE(0,88)-(255,96),PSET,BF
230 L=65:P=5504:GOSUB1230
240 P=5952:GOSUB1230
250 P=6016:GOSUB1230
260 P=6528:GOSUB1230
270 L=0:P=4192:GOSUB1230:P=4256:GOSUB1230
280 P=4704:GOSUB1230:P=4768:GOSUB1230
290 P=7040:GOSUB1230:P=7104:GOSUB1230
300 P=80:GOSUB1260:P=96:GOSUB1260:P=168:GOSUB1260
310 '
320 '
330 REM draw ships bow
340 DATA170,138,138,138,0,128,160,168,170,170,170,170,
130,0,0,0
350 REM get shape
360 GOSUB1120
370 REM put shapes unto picture grid
380 PX=1:PY=2:GOSUB1210:PX=9:GOSUB1210:PX=17:GOSUB1210
:PX=24:GOSUB1210
390 PY=6:PX=6:GOSUB1210:PX=17:GOSUB1210:PX=28:GOSUB121
0
400 '
410 '
420 REM draw ships centre
430 DATA170,170,170,170,130,0,0,0,170,170,170,170,130,
0,0,0
440 GOSUB1120
450 PY=2:PX=3:GOSUB1210:PX=11:GOSUB1210
460 PY=6:PX=19:GOSUB1210:PX=30:GOSUB1210
470 REM draw ships stern
480 DATA170,170,170,170,130,0,0,0,42,2,34,34,0,0,2,2
490 GOSUB1120
500 PY=2:PX=4:GOSUB1210:PX=12:GOSUB1210:PX=19:GOSUB121
0:PX=26:GOSUB1210
510 PY=6:PX=0:GOSUB1210:PX=8:GOSUB1210:PX=21:GOSUB1210
520 REM draw crocodile
530 DATA170,170,169,169,165,149,85,170,169,165,150,90,
106,105,85,170
540 GOSUB1120
550 PY=4:PX=1:GOSUB1210:PX=8:GOSUB1210:PX=15:GOSUB1210
:PX=20:GOSUB1210:PX=28:GOSUB1210
560 PY=8:PX=0:GOSUB1210:PX=10:GOSUB1210:PX=17:GOSUB121
0:PX=26:GOSUB1210
570 REM draw first car type
580 DATA85,93,135,127,255,255,69,69,213,117,117,253,25
5,255,69,69
590 GOSUB1120
600 PY=14:PX=2:GOSUB1210:PY=16:PX=8:GOSUB1210:PX=14:GO
SUB1210:PX=28:GOSUB1210
610 PY=20:PX=6:GOSUB1210:PY=18:PX=21:GOSUB1210
620 REM etc. for rest of traffic
630 DATA85,86,89,101,170,170,69,69,85,165,101,89,170,1
70,81,81
640 GOSUB1120
650 PY=16:PX=18:GOSUB1210:PY=18:PX=7:GOSUB1210:PX=12:G
OSUB1210:PY=20:PX=10:GOSUB1210
660 DATA85,84,81,69,0,0,69,69,85,5,69,81,0,0,81,81
670 GOSUB1120
680 PY=14:PX=8:GOSUB1210:PY=16:PX=2:GOSUB1210:PY=18:PX
=20:GOSUB1210
690 DATA69,69,85,64,68,0,20,20
700 GOSUB1290
710 PY=14:PX=5:GOSUB1370:PX=10:GOSUB1370:PX=20:GOSUB13
70
720 DATA81,81,85,1,17,0,20,20
730 GOSUB1290
740 PY=20:PX=13:GOSUB1370:PX=16:GOSUB1370:PX=27:GOSUB1
370
750 DATA106,106,106,106,106,170,81,81,170,170,170,170,
170,170,21,21
760 GOSUB1120
770 PY=14:PX=12:GOSUB1210:PX=14:GOSUB1210
780 DATA85,169,153,154,170,170,69,69
790 GOSUB1290
800 PY=14:PX=16:GOSUB1370
810 DATA170,170,85,170,85,170,17,17,85,169,85,169,85,1
70,85,85
820 GOSUB1120
830 PY=14:PX=24:GOSUB1210
840 DATA1,21,21,0,0,0,81,81
850 GOSUB1290
860 PY=14:PX=26:GOSUB1370
870 DATA106,127,106,127,106,255,85,85,170,255,170,255,
170,255,17,17
880 GOSUB1120
890 PY=20:PX=0:GOSUB1210
900 DATA106,86,86,170,170,170,69,69
910 GOSUB1290
920 PY=20:PX=31:GOSUB1370
930 DATA64,84,84,0,0,0,69,69
940 GOSUB1290
950 PY=20:PX=19:GOSUB1370
960 DATA64,64,74,79,64,0,85,85,0,0,168,252,0,0,17,17
970 GOSUB1120
980 PY=20:PX=20:GOSUB1210:PX=22:GOSUB1210
990 DATA195,195,40,60,40,255,130,195
1000 GOSUB1290
1010 PY=22:PX=16:GOSUB1370
1020 REM draw waves
1030 DATA170,138,130,136,42,170,34,170
1040 GOSUB1290
1050 PY=2:PX=4:GOSUB1340
1060 PX=12:GOSUB1340:PX=19:GOSUB1340:PX=27:GOSUB1340
1070 PY=5:PX=2:GOSUB1340:PX=9:GOSUB1340:PX=16:GOSUB134
0:PX=24:GOSUB1340
1080 PY=7:PX=4:GOSUB1340:PX=12:GOSUB1340:PX=19:GOSUB13
40:PX=27:GOSUB1340
1090 PY=9:PX=2:GOSUB1340:PX=9:GOSUB1340:PX=16:GOSUB134
0:PX=24:GOSUB1340
1100 GOTO1390
1110 REM routine to poke graphic to screen for double
width chr.
1120 FORT=0 TO 7:READA:POKE1536+(T*32),A:NEXT
1130 FORT=0 TO 7:READA:POKE1537+(T*32),A:NEXT
1140 REM get double graphic
1150 GET(0,0)-(15,7),C2,G
1160 RETURN
1170 REM put blank graphic
1180 PUT(PX*8,PY)-((PX*8)+7,PY+7),BL,PSET
1190 RETURN
1200 REM put double graphic
1210 PUT(PX*8,PY*8)-((PX*8)+15,(PY*8)+7),C2,PSET
1220 RETURN
1230 FORT=0 TO 31:POKEP+T,L:NEXT
1240 RETURN
1250 GOTO1250
1260 FORT=4 TO 255 STEP10:LINE(T,P)-(T,P+7),PSET:NEXT
1270 RETURN
1280 REM single graphic poke to screen
1290 FORT=0 TO 7
1300 READA:POKE1536+(T*32),A:NEXTT
1310 REM get single graphic block
1320 GET(0,0)-(7,7),C1,G
1330 RETURN
1340 FORT=0 TO 2:GOSUB1370:PX=PX+1:NEXT
1350 RETURN
1360 REM put single graphic
1370 PUT(PX*8,PY*8)-((PX*8)+7,(PY*8)+7),C1,PSET
1380 RETURN
1390 COLOR8
1400 LINE(0,0)-(255,7),PSET,BF
1410 PY=0:PX=3:GOSUB1180:PX=11:GOSUB1180:PX=19:GOSUB11
80:PX=27:GOSUB1180
1420 DRAW"BM0,192;U4NR4D2R4BD2;BR4U4R3FGNL3FD2;BR4U4R4
D4NL4;BR4U4NR4D4R4NU2;BR4R4U2L4U2R4BD4
1430 A$="R4U2L4U2R4BD4BR4NR4U4R4BD4BR4NR4U4R4D4BR4U4R[illegible]
FGNL3FD2BR4NR4U2NR4U2R4"
1440 DRAW"BM64,192;U4D2R4U2D4BR4NU4BR4BU2R4BD2BR4"+A$
1450 DRAW"BM168,192"+A$
1460 REM to record the screen   remove line 1460
1470 GOTO1470
1480 FORT=1 TO 4:PCOPYT TO T+4:NEXTT
1490 CSAVEM"PICTURE",7680,13823,6143
```

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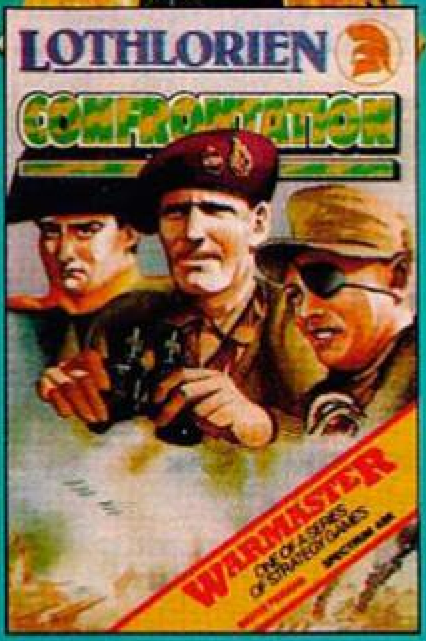

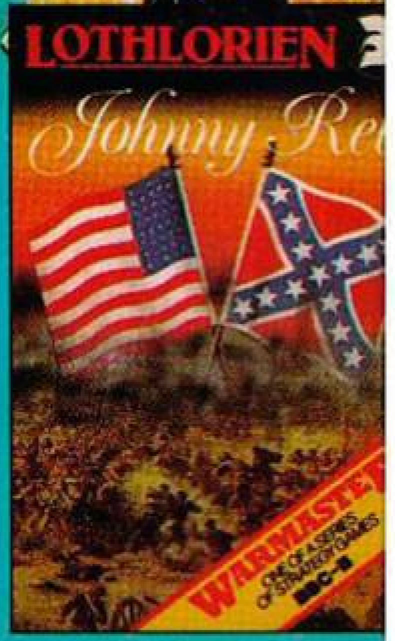

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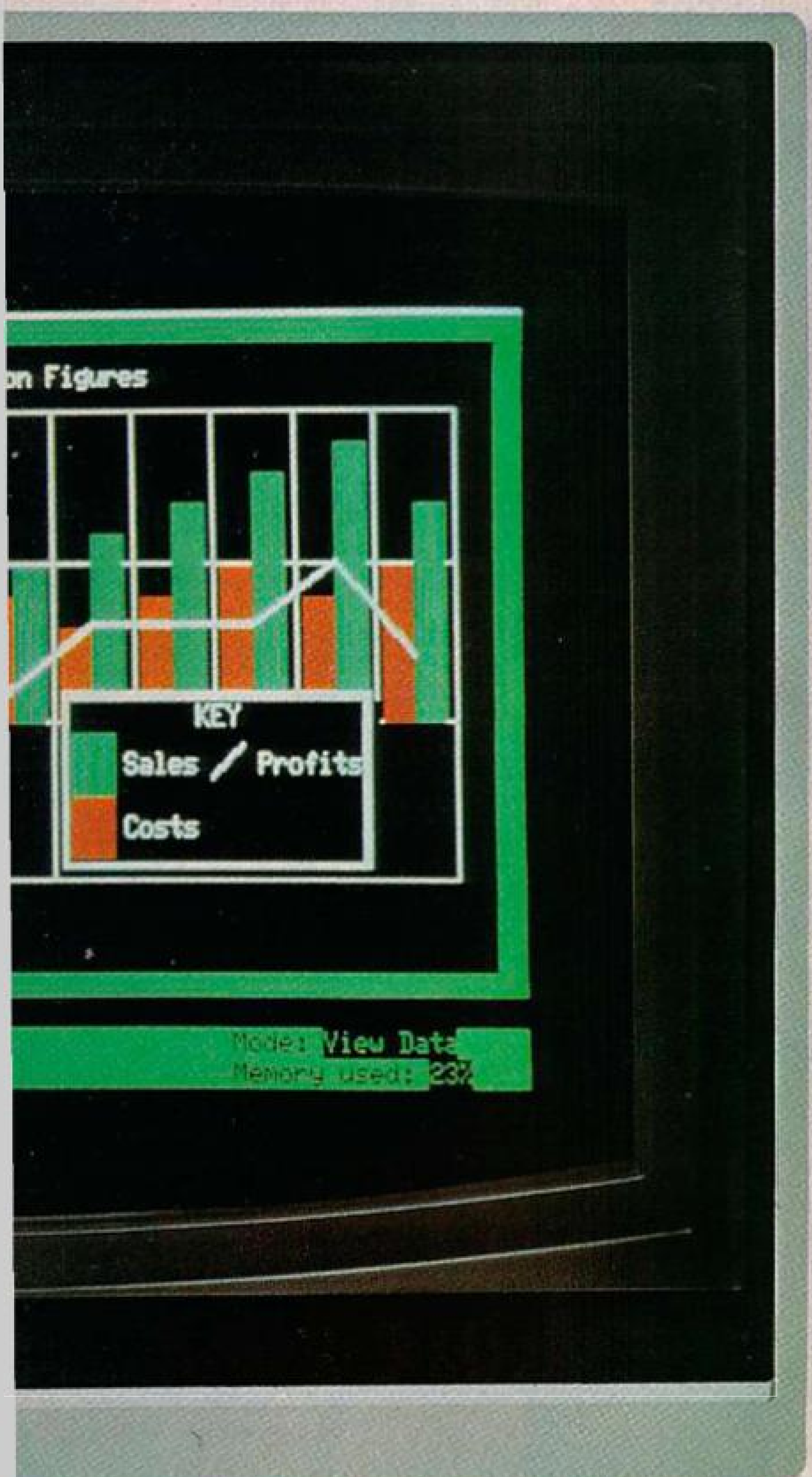
New-Sinclair QL
There's no comparison chart, b



The Sinclair QL is a new computer.

Not just a new Sinclair computer, but a totally new sort of computer – nothing like it exists anywhere.

It's not just a bit better than this, or a bit cheaper than that – it's a computer that's very hard to compare with anything. Just check the features below – and if you don't agree, take up the challenge at the end of the advertisement.

If you do agree, there's only one course of action you can take... get yourself a Sinclair QL at the earliest possible moment.

The Sinclair QL has 128K RAM. Big deal?

Several micros offer 128K RAM, or more, as standard. The 'What Micro?' table for December 1983 lists over 50 of them – but 40 of the 50 micros listed cost over £2,500!

The Sinclair QL offers you 128K RAM for under £400, and an option to expand to 640K. That's a lot of bytes to the pound!

The Sinclair QL has a 32-bit processor. Who else?

Under £2,700, nobody. Even the new generation of business computers, such as the IBM PC, are only now beginning to use 16-bit processors.

At prices like this, the Motorola 68000 family – widely regarded as the most powerful microprocessors available – will remain a luxury.

Yet with the Sinclair QL, the 32-bit Motorola 68008 is available for less than £400.

You can also be sure that the QL will not become outdated. 32-bit architecture is future-proof.

32-bit processor architecture, 128K RAM, and QDOS combine to give the QL the performance of a mini-computer for the price of a micro.

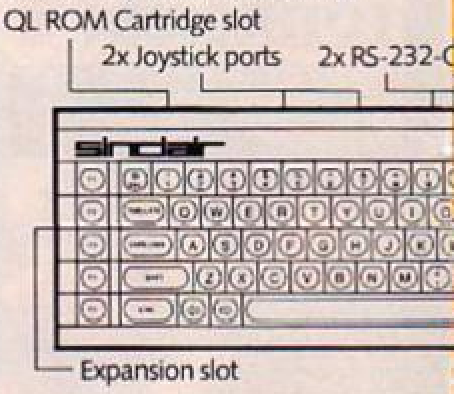
Exclusive: new QDOS operating system

No competition! QDOS sets a new standard in operating systems for the 68000 family of processors, and may well become the industry standard.

QDOS is a single-user, multi-tasking, time-sliced system using Sinclair's new SuperBASIC as a command language.

One of its most significant features is its very powerful multi-tasking capability – the ability to run several programs individually and simultaneously. It can also display the results simultaneously in different portions of the screen. These are features not normally available on computers costing less than £7,000.

Eleven input/output ports

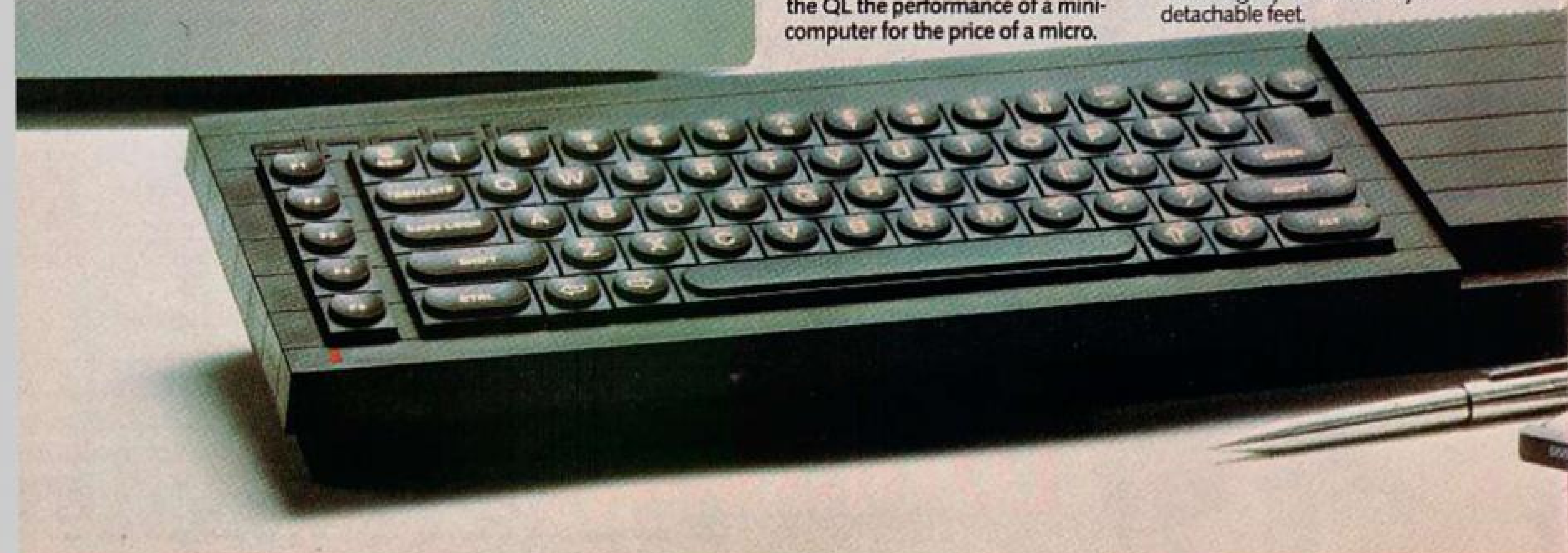


New professional keyboard

The QL keyboard is designed for fast input of data and programs.

It is a full-size QWERTY keyboard, with 65 keys, including a space bar; left-and right-hand shift keys; five function keys; and four separate cursor-control keys – key action is positive and precise.

A membrane beneath the keyboard protects the machine from dust (and coffee!), and for users who find an angled keyboard more comfortable, the computer can be raised slightly at the back by small detachable feet.



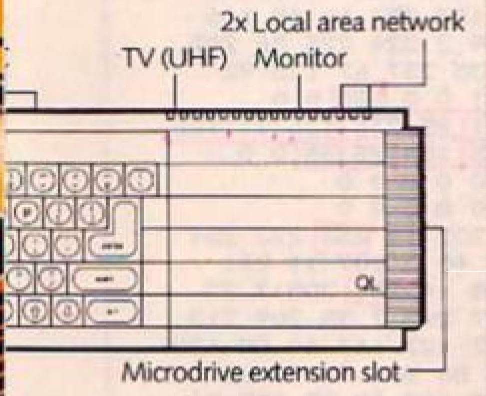
£399

…because there's no comparison!

Advanced new friendly language – Sinclair SuperBASIC

The new Sinclair SuperBASIC combines the familiarity of BASIC with a number of major developments which allow the QL's full power to be exploited.

Unlike conventional BASIC, its procedure facility allows code to be written in clearly-defined blocks; extendability allows new procedures to be added which will work in exactly the same way as the command procedures built into the ROM; and its constant execution speed means that SuperBASIC does not get slower as programs get larger.



Two 100K microdrives built in

The Microdrives for the Sinclair QL are identical in principle to the popular and proven ZX Microdrives, but give increased capacity (at least 100K bytes each) and a faster data-transfer rate. Typical access speed is 3.5 seconds, and loading is at up to 15K bytes per second. The Sinclair QL has two built-in Microdrives. If required, a further six units can be connected.

Four blank cartridges are supplied with the machine.

Included – superb professional software

The suite of four programs is written by Psion specially for the QL and incorporates many major developments. All programs use full colour, and data is transportable from one to another. (For example, figures can be transferred from spreadsheet to graphics for an instant visual presentation.)

Word-processing

Certain to set a new standard of excellence, QL Quill uses the power of the QL to show on the screen exactly what you key in, and to print out exactly what you see on the screen.

A beginner can be using QL Quill for word-processing within minutes.

QL Quill brings you all the facilities of a very advanced word-processing package.

Business graphics

QL Easel is a high-resolution colour program so easy to use you probably won't refer to the manual! It handles anything from lines, shaded curves or histograms to overlapping or stacked bars or pie charts. QL Easel does not require you to format your display before entering data; it handles design and scaling automatically or under your control. Text can be added and altered as simply as data.

Spreadsheet

QL Abacus makes simultaneous calculations and 'what if' model-construction easier than they've ever been. Sample applications are provided, including budget-planning and cash-flow analysis. QL Abacus allows you to refer to rows, columns and cells by names, not just letters and numbers. Function keys can be assigned to change a variable and carry out a complete 'what if' calculation with a single key-stroke.

Database management

QL Archive is a very powerful filing system which sets new standards, using a language even simpler than BASIC. It combines ease of use for simple applications – such as card indices – with huge power as a multi-file data processor.

An easy-to-use labelling facility means that you don't have to ask for your file by its full name – a few letters are enough.

New – the Sinclair QLUB

The QLUB is the QL Users Bureau. Membership is open to all QL owners. For an annual subscription of £35, QLUB members receive one free update to each of the four programs supplied with the QL, and six bi-monthly newsletters. Sinclair has also made exclusive arrangements for QLUB members to obtain software assistance on QL Quill, Abacus, Archive or Easel by writing to Psion.

The Sinclair QL challenge

If you're seriously considering any other computer, post the coupon for a blow-by-blow comparison. We'll take a *published* comparison chart for the machine you're considering (not one we've created ourselves) and give you the Sinclair QL figures, detail by detail.

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DISPLAY

Richard Taylor points the way to better graphics display commands for the 16K and 48K Spectrum.

Listing 1.

```
64624 - 253 203 12 126 192 42
64630 - 93 92 229 42 69 92
64636 - 205 110 25 253 86 13
64642 - 20 30 0 205 136 25
64648 - 48 14 42 85 92 62
64654 - 192 166 32 11 35 35
64660 - 35 34 93 92 231 254
64666 - 234 40 2 207 11 231
64672 - 17 224 252 229 26 230
64678 - 127 79 223 246 32 185
64684 - 32 9 231 26 19 23
64690 - 48 240 225 24 17 26
64696 - 19 23 48 251 19 19
64702 - 26 225 34 93 92 167
64708 - 32 221 207 11 235 94
64714 - 35 86 235 205 223 252
64720 - 223 254 47 40 202 225
64726 - 34 93 92 217 33 88
64732 - 39 217 201 233 108 105
64738 - 110 229 74 253 98 111
64744 - 248 145 253 99 105 114
64750 - 99 108 229 50 254 112
64756 - 97 105 110 244 210 253
64762 - 109 111 118 229 199 253
64768 - 119 99 108 243 225 254
64774 - 116 101 109 112 243 180
64780 - 253 0 205 25 253 223
64786 - 254 44 40 2 207 11
64792 - 231 223 205 136 44 48
64798 - 247 205 141 44 56 18
64804 - 205 59 45 223 254 13
64810 - 200 254 44 200 254 47
64816 - 200 254 41 200 207 11
64822 - 229 231 205 39 253 225
64828 - 34 93 92 205 178 40
64834 - 56 4 35 195 180 51
64840 - 207 1 223 254 40 32
64846 - 39 231 205 14 253 205
64852 - 7 35 205 229 34 223
64858 - 254 41 32 22 231 254
64864 - 45 32 17 231 254 40
64870 - 32 12 231 205 14 253
64876 - 223 254 41 32 3 231
64882 - 24 5 207 11 205 14
64888 - 253 253 126 68 205 40
64894 - 45 253 126 67 205 40
64900 - 45 239 192 2 3 1
64906 - 224 3 1 56 195 183
64912 - 36 205 14 253 239 49
64918 - 160 1 56 205 183 36
64924 - 239 1 49 160 56 205
64930 - 183 36 239 1 27 160
64936 - 1 56 205 183 36 239
64942 - 27 160 56 195 183 36
64948 - 253 203 2 134 205 77
64954 - 13 33 144 92 126 246
64960 - 248 119 253 203 87 182
64966 - 201 205 14 253 205 7
64972 - 35 237 67 125 92 201
64978 - 237 75 125 92 80 89
64984 - 205 242 253 56 6 4
64990 - 120 254 176 56 245 66
64996 - 120 5 167 200 205 242
65002 - 253 216 120 5 167 32
65008 - 247 201 75 205 27 254
65014 - 48 6 121 187 55 200
65020 - 24 3 12 32 242 75
65026 - 121 13 167 55 63 200
65032 - 205 27 254 48 7 123
65038 - 61 185 55 200 183 201
65044 - 121 13 167 32 239 183
65050 - 201 197 213 205 170 34
65056 - 71 4 126 7 16 253
65062 - 56 7 121 230 7 205
65068 - 236 34 183 209 193 201
65074 - 253 126 67 205 40 45
65080 - 253 126 68 205 40 45
65086 - 205 14 253 239 164 5
65092 - 195 2 194 2 193 2
65098 - 192 2 160 226 227 4
65104 - 56 205 213 45 79 58
65110 - 125 92 129 50 125 92
65116 - 239 49 52 64 176 0
65122 - 90 5 163 4 49 56
65128 - 33 195 254 34 104 92
65134 - 239 32 56 33 146 92
65140 - 34 104 92 239 226 4
65146 - 227 4 224 15 1 56
65152 - 33 195 254 34 104 92
65158 - 239 31 56 33 146 92
65164 - 34 104 92 239 226 4
65170 - 225 15 56 33 195 254
65176 - 34 104 92 205 121 253
65182 - 33 146 92 34 104 92
65188 - 239 164 162 4 15 49
65194 - 56 205 162 45 33 104
65200 - 1 183 237 66 48 166
65206 - 239 2 224 225 56 205
65212 - 7 35 237 67 125 92
65218 - 201 0 0 135 0 0
65224 - 121 25 236 136 91 126
65230 - 155 154 95 35 0 0
65236 - 0 0 0 0 0 0
65242 - 0 0 0 0 0 0
65248 - 0 205 14 253 223 254
65254 - 44 40 2 207 11 231
65260 - 205 14 253 205 7 35
65266 - 197 205 7 35 209 213
65272 - 197 123 167 40 89 129
65278 - 56 86 254 33 48 82
65284 - 122 167 40 78 128 56
65290 - 75 254 23 48 71 209
65296 - 62 24 146 71 205 155
65302 - 14 22 0 25 193 203
65308 - 32 203 32 203 32 197
65314 - 229 54 0 229 35 235
65320 - 225 13 6 0 120 177
65326 - 40 2 237 176 225 193
65332 - 36 124 230 7 32 25
65338 - 37 229 197 229 205 219
65344 - 11 225 35 13 32 247
65350 - 193 225 36 125 198 32
65356 - 111 63 159 230 248 132
65362 - 103 16 204 201 207 10
```

THE SPECTRUM HAS A distinct lack of commands to produce graphic displays. Its Plot, Draw and Circle commands are very rudimentary and do nothing to exploit the full graphic potential of this high resolution machine. To produce displays worthy of this machine's graphic capabilities requires a complex and confusing assortement of the vague statements that Sinclair Basic does posses. Other machines often have commands to draw ellipses, rectangles and triangles and the additional facility to paint specific areas of the screen in different colours. In order to partially remedy this fundamental problem, I present a machine-code program for both the 16K and 48K machines.

The decimal dump for the 48K machine is shown in listing 1. The machine code is 744 bytes long. It may take quite a time to enter all these numbers, but the facilities the program provides are well worth the effort. If you are the owner of a 16K machine then use the decimal code from listing 8 rather than that from listing 1. To enter the numbers into

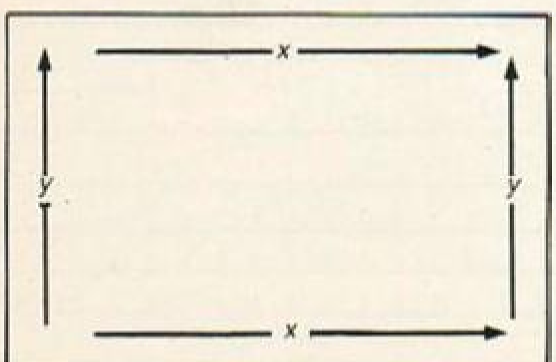

Figure 1.

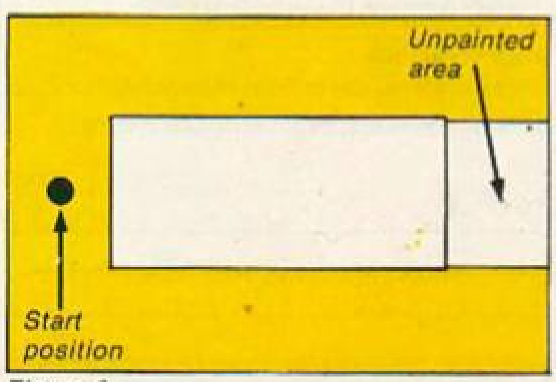

Figure 2.

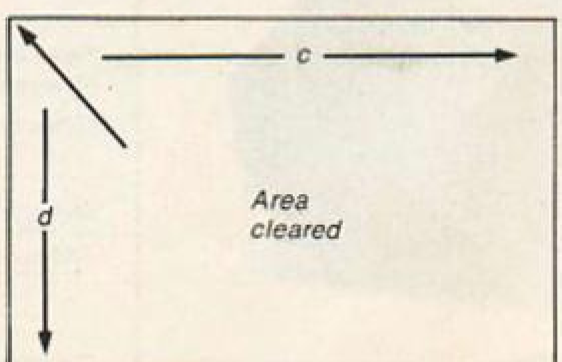

Figure 3.

your Spectrum you need a decimal loader program. Such a program is shown in listing 2 — listing 9 for 16K owners. Simply type in the program shown in listing 2 or 9, Run it and enter the decimal code from the appropriate decimal dump.

It is important to ensure that the numbers go into the correct addresses, which are shown along the left hand side of the decimal dump listing. When you have completed the task of entering the numbers, one of two things will happen. If the computer prints "Error" on the screen then you have made a mistake in one or more of the numbers. To locate your mistakes and correct them, follow the below procedure:

Type in listing 3 if you are a 48K owner or listing 10 if you are an owner of a 16K machine. When Run, the program will ask you if you have got a printer. Typing "yes" will mean hat the succeeding output will be directed to the printer rather than to the screen.

You now have to check the output with the original listing. Any deviation has to be corrected by finding out the address of the deviant byte and entering

POKE (address), (what the number should be)

Once you have done this, the program should work all right.

If the program did not print "Error" on the screen then there is absolutely no need to go through the above procedure. It is now wise to save the machine code on tape.

(continued on page 133)

GRAPHICS

Listing 8.

```
31856 - 253 203 12 126 192 42
31862 - 93 92 229 42 69 92
31868 - 205 110 25 253 86 13
31874 - 20 30 0 205 136 25
31880 - 48 14 42 85 92 62
31886 - 192 166 32 11 35 35
31892 - 35 34 93 92 231 254
31898 - 234 40 2 207 11 231
31904 - 17 224 124 229 26 230
31910 - 127 79 223 246 32 185
31916 - 32 9 231 26 19 23
31922 - 48 240 225 24 17 26
31928 - 19 23 48 251 19 19
31934 - 26 225 34 93 92 167
31940 - 32 221 207 11 235 94
31946 - 35 86 235 205 223 124
31952 - 223 254 47 40 202 225
31958 - 34 93 92 217 33 88
31964 - 39 217 201 233 108 105
31970 - 110 229 74 125 98 111
31976 - 248 145 125 99 105 114
31982 - 99 108 229 50 126 112
31988 - 97 105 110 244 210 125
31994 - 109 111 118 229 199 125
32000 - 119 99 108 243 225 126
32006 - 116 101 109 112 243 180
32012 - 125 0 205 25 125 223
32018 - 254 44 40 2 207 11
32024 - 231 223 205 136 44 48
32030 - 247 205 141 44 56 18
32036 - 205 59 45 223 254 13
32042 - 200 254 44 200 254 47
32048 - 200 254 41 200 207 11
32054 - 229 231 205 39 125 225
32060 - 34 93 92 205 178 40
32066 - 56 4 35 195 180 51
32072 - 207 1 223 254 40 32
32078 - 39 231 205 14 125 205
32084 - 7 35 205 229 34 223
32090 - 254 41 32 22 231 254
32096 - 45 32 17 231 254 40
32102 - 32 12 231 205 14 125
32108 - 223 254 41 32 3 231
32114 - 24 5 207 11 205 14
32120 - 125 253 126 68 205 40
32126 - 45 253 126 67 205 40
32132 - 45 239 192 2 3 1
32138 - 224 3 1 56 195 183
32144 - 36 205 14 125 239 49
32150 - 160 1 56 205 183 36
32156 - 239 1 49 160 56 205
32162 - 183 36 239 1 27 160
32168 - 1 56 205 183 36 239
32174 - 27 160 56 195 183 36
32180 - 253 203 2 134 205 77
32186 - 13 33 144 92 126 246
32192 - 248 119 253 203 87 182
32198 - 201 205 14 125 205 7
32204 - 35 237 67 125 92 201
32210 - 237 75 125 92 80 89
32216 - 205 242 125 56 6 4
32222 - 120 254 176 56 245 66
32228 - 120 5 167 200 205 242
32234 - 125 216 120 5 167 32
32240 - 247 201 75 205 27 126
32246 - 48 6 121 187 55 200
32252 - 24 3 12 32 242 75
32258 - 121 13 167 55 63 200
32264 - 205 27 126 48 7 123
32270 - 61 185 55 200 183 201
32276 - 121 13 167 32 239 183
32282 - 201 197 213 205 170 34
32288 - 71 4 126 7 16 253
32294 - 56 7 121 230 7 205
32300 - 236 34 183 209 193 201
32306 - 253 126 67 205 40 45
32312 - 253 126 68 205 40 45
32318 - 205 14 125 239 164 5
32324 - 195 2 194 2 193 2
32330 - 192 2 160 226 227 4
32336 - 56 205 213 45 79 58
32342 - 125 92 129 50 125 92
32348 - 239 49 52 64 176 0
32354 - 90 5 163 4 49 56
32360 - 33 195 126 34 104 92
32366 - 239 32 56 33 146 92
32372 - 34 104 92 239 226 4
32378 - 227 4 224 15 1 56
32384 - 33 195 126 34 104 92
32390 - 239 31 56 33 146 92
32396 - 34 104 92 239 226 4
32402 - 225 15 56 33 195 126
32408 - 34 104 92 205 121 125
32414 - 33 146 92 34 104 92
32420 - 239 164 162 4 15 49
32426 - 56 205 162 45 33 104
32432 - 1 183 237 66 48 166
32438 - 239 2 224 225 56 205
32444 - 7 35 237 67 125 92
32450 - 201 0 0 0 0 0
32456 - 0 0 0 0 0 0
32462 - 0 0 0 0 0 0
32468 - 0 0 0 0 0 0
32474 - 0 0 0 0 0 0
32480 - 0 205 14 125 223 254
32486 - 44 40 2 207 11 231
32492 - 205 14 125 205 7 35
32498 - 197 205 7 35 209 213
32504 - 197 123 167 40 89 129
32510 - 56 86 254 33 48 82
32516 - 122 167 40 78 128 56
32522 - 75 254 23 48 71 209
32528 - 62 24 146 71 205 155
32534 - 14 22 0 25 193 203
32540 - 32 203 32 203 32 197
32546 - 229 54 0 229 35 235
32552 - 225 13 6 0 120 177
32558 - 40 2 237 176 225 193
32564 - 36 124 230 7 32 25
32570 - 37 229 197 229 205 219
32576 - 11 225 35 13 32 247
32582 - 193 225 36 125 198 32
32588 - 111 63 159 230 248 132
32594 - 103 16 204 201 207 10
```

Listing 2.

```
  10 CLEAR 64623
  20 LET total=0
  30 PRINT AT 21,0;
  40 FOR a=64624 TO 65367
  50 INPUT "Byte? ";b
  60 POKE a,b: LET total=total+b
  70 POKE 23692,-1
  80 PRINT a;" - ";PEEK a
  90 NEXT a
 100 IF total<>89072 THEN PRINT
FLASH 1; BRIGHT 1;"ERROR": BEEP
3,-30
```

Listing 3.

```
  10 CLOSE #2: INPUT "Do you hav
e a Printer? ";a$
  20 IF a$(1)="y" OR a$(1)="Y" T
HEN OPEN #2,"p"
  30 LET a=31855
  40 PRINT a;" - ";
  50 FOR b=0 TO 5
  60 PRINT TAB 8+b*4;PEEK (a+b);
  70 NEXT b
  80 LET a=a+6
  90 IF a<32600 THEN PRINT : GO
TO 40    100 CLOSE #2
```

Listing 4.

```
  10 FOR a=0 TO 255 STEP 8
  20 RANDOMIZE USR 64624: REM te
mps/line(0,0)-(a,175)
  30 NEXT a
  40 FOR a=0 TO 255 STEP 5
  50 RANDOMIZE USR 64624: REM te
mps/line(a,0)-(a,175)
  60 NEXT a
```

Listing 5.

```
  10 FOR a=0 TO 10 STEP .25
  20 LET b=a*7.5: LET d=b+40
  30 LET c=175-(a*15)
  40 RANDOMIZE USR 64624: REM te
mps/moved,b/boxc,c
  50 NEXT a
```

Listing 6.

```
  10 FOR a=1 TO 18
  20 RANDOMIZE USR 64624
  30 REM temps/move128,88/circle
70,a
  40 NEXT a
```

Listing 7.

```
  10 RANDOMIZE USR 64624: REM TE
MPS/MOVE128,88/CIRCLE10,20
  20 RANDOMIZE USR 64624: REM TE
MPS/MOVE128,88/CIRCLE65,6
  30 CIRCLE 128,88,80
  40 PRINT INK 2;
  50 RANDOMIZE USR 64624
  60 REM MOVE128,88/PAINT
  70 PRINT INK 1;
  80 RANDOMIZE USR 64624
  90 REM MOVE85,88/PAINT/MOVE172
,88/PAINT/MOVE128,20/PAINT/MOVE1
28,155/PAINT
```

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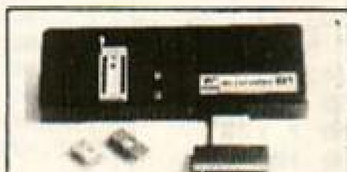

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STATUS
NO. OF SYSTEM —HEX
EPROM TYPE —27128
RAM START ADDR —4000
EPROM ST. ADDR — 0000
JOB LENGTH — 4000
TASK — CHECK

WHICH TASK DO YOU WISH TO DO
W) CHECK THAT EPROM IS CLEAN
X) READ THE CONTENTS OF EPROM INTO RAM
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IMPORTANT: FOR 48K SPECTRUM ONLY

(continued from page 131)

48K owners should use

SAVE "Graphics"CODE 64624,744

16K owners should use

SAVE "Graphics"CODE 31856,744

To load the program back into the machine use:

For 48K owners

CLEAR 64623: LOAD ""CODE

For 16K owners

CLEAR 31855: LOAD ""CODE

The commands are put in Rem statements. Each Rem statement which contains the new commands must be preceded by a

RANDOMIZE USR 64624

on 48K machines and

RANDOMIZE USR 31856

on 16K machines. The Rem statement must be the next command after this machine-code call instruction, be it the next statement on the same line or the first statement on the following line. If this rule is neglected then the computer will respond with error C — "Nonsense in Basic".

Whether you type the commands in in upper or lower case or a combination of the two, the new statements will be recognized by the computer. If any sort of error occurs as a result of incorrect syntax, it will be interpreted by the computer as an error C.

In normal Basic commands which print onto the display, it is possible to put colour parameters just after the keyword. This is not possible with the new commands so you must use a slightly different method. If you intend to use the universal colours which have been set up using the Ink, Paper, Flash, Bright, Over and Inverse commands as solitary statements then you must make the first command in the Rem statement a Temps.

This merely indicates to the computer that you wish to use the universal colours in all succeeding commands in that Rem statement. conversely, if you wish to set up your own temporary colours then you must place a dummy print statement as the statement preceding the Rand USR instruction. This print statement contains the colour information. For example

PRINT INK 3;PAPER 7;

will set the colours to magenta ink on yellow paper. The print statement does not actually affect the contents of the screen, only the temporary colours. When using this method, no Temps command is required as you are not using the universal colours. There now follows a description of each of the six commands:

Move x,y: This command simply moves the plot position to x,y. As Sinclair Basic stands, it has no facility to do this unless you use PLOT INVERSE 1; OVER 1; INK 8; PAPER 8; BRIGHT 8; FLASH 8,x,y but this is a little bit complicated. The command is especially useful for moving the plot position prior to using a paint command.

The two parameters, x and y, can be entered in one of a couple of ways. either you can put the number in directly — ie.,

MOVE 128,88

or you can use a variable name — ie.,

MOVE a,b

The only stipulation when using variables is that it must be a single letter simple numeric variable. If you use a variable that is not defined then the computer will respond with the usual error 2 — "Variable not found".

The above notes apply to any of the other new commands which have parameters. Please note that you are not allowed to do any mathematics in the parameters eg.,

MOVE a – 1, b/3

Instead you could do something like

LET x = a – 1: LET y = b/3

and then

MOVE x,y

Line x,y or lines (x1,y1)–(x2,y2): The Line command has two different possible formats. The first format has the form

LINE x,y

where x and y are the co-ordinates of a point on the screen. The command draws a line from the last position plotted to the point supplied. The advantage of this is that it uses real screen points rather than the relative displacements used on the Sinclair Draw command.

This method is often more easy to use. The colour of the line is determined by a dummy Print statement preceding the Rand USR command if you are using temporary colours or by a preceding Temps instruction if you are using the universal colours. The second form of the command is slightly different and is similiar to the line command found on micro-computers running Microsoft Basic.

Its form is

LINE (x1,y1) – (x2,y2)

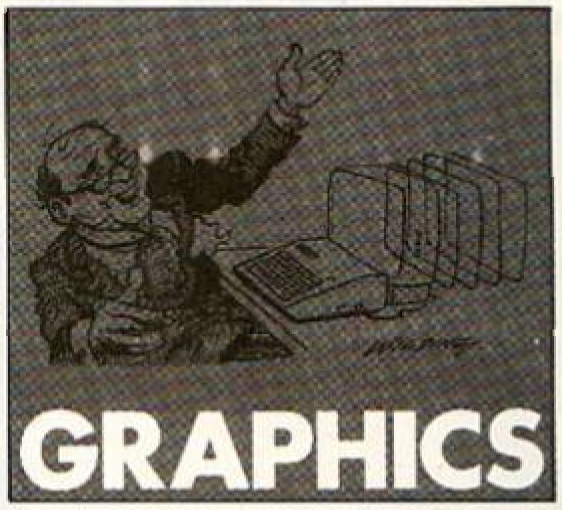
It draws a line from the point x1,y1 to the point x2,y2. This has the same effect as the rather more cumbersome

MOVE x1,y1/LINE x2,y2

Box x,y: This command draws a rectangle on screen at the current position with a length of x and a height of y. the last plotted position is used as the bottom left hand corner of the rectangle.

Again, the colour of the box is determined in a similar way to that in the previous command — Line.

Circle x,y: Unlike the normal circle command, this one allows you to draw ellipses as well as normal circles. The circle's centre is determined by the last plotted position. The first of the two parameters, x, is the radius of the circle while the second parameter gives the height-width ratio of the circle. This must be in the range of 1 to 255,10 being the ratio for a normal circle.



Paint: This command allows you to paint a particular area of the screen in a certain colour. The command paint from the last plotted position in all directions until it reaches an ink border. It is important that the start position is not a point which has been plotted to an ink colour — hence the need for a Move command — otherwise the computer will think that that is an ink border and the painting will not go as you would expect it to. The routine will not paint behind objects which are in the start position's "shadow". See figure 2.

It is sometimes necessary to start from a couple of points to completely paint an irregular area. The command will, however, properly paint any rectangle where ever the start position is as long as it is inside the rectangle's boundaries.

WCLS a,b,c,d: This command allows you to clear part of the screen, while leaving the remainder intact. This is often a useful facility when you are using different parts of the screen for different purposes. The parameters a and b describe the column and line positions respectively of the top left hand corner of the area to be cleared.

Parameter c describes how many columns are to be cleared while the final parameter, d, describes how many lines are to be cleared. As you may have noticed, these line and column numbers are given the opposite way around to the way in which they are given for the Print At instruction which has the line number first, followed by the column number. The screen area cleared is described in a diagramatic form in figure 3.

The colour of the cleared area is described in the normal fashion for the new commands. Please note, however, when using the Temps command the area is cleared with

PAPER 8; FLASH 8; BRIGHT 8;

so that only the ink colour is actually altered. This situation can be remedied by using an empty dummy print statement instead of a Temps command — ie.

PRINT

Listing 4 to 7 give example uses of the new commands and serve to clear up any misunderstandings you might have converning the syntax. As the listings stand, they will only work with the 48K version. To use them in conjunction with the 16K program you must change any occurence of Rand USR 64624 to Rand USR 31856. ■

Listing 9.

```
10 CLEAR 31855
20 LET total=0
30 PRINT AT 21,0;
40 FOR a=31856 TO 32599
50 INPUT "Byte? ";b
60 POKE a,b: LET total=total+b
70 POKE 23692,-1
80 PRINT a;" - ";PEEK a
90 NEXT a
100 IF total<>84189 THEN PRINT
FLASH 1; BRIGHT 1;"ERROR": BEEP
3,-30
```

Listing 10.

```
10 CLOSE #2: INPUT "Do you hav
e a Printer? ";a$
20 IF a$(1)="y" OR a$(1)="Y" T
HEN OPEN #2,"p"
30 LET a=64624
40 PRINT a;" - ";
50 FOR b=0 TO 5
60 PRINT TAB 8+b*4;PEEK (a+b);
70 NEXT b
80 LET a=a+6
90 IF a<65368 THEN PRINT : GO
TO 40
100 CLOSE #2
```

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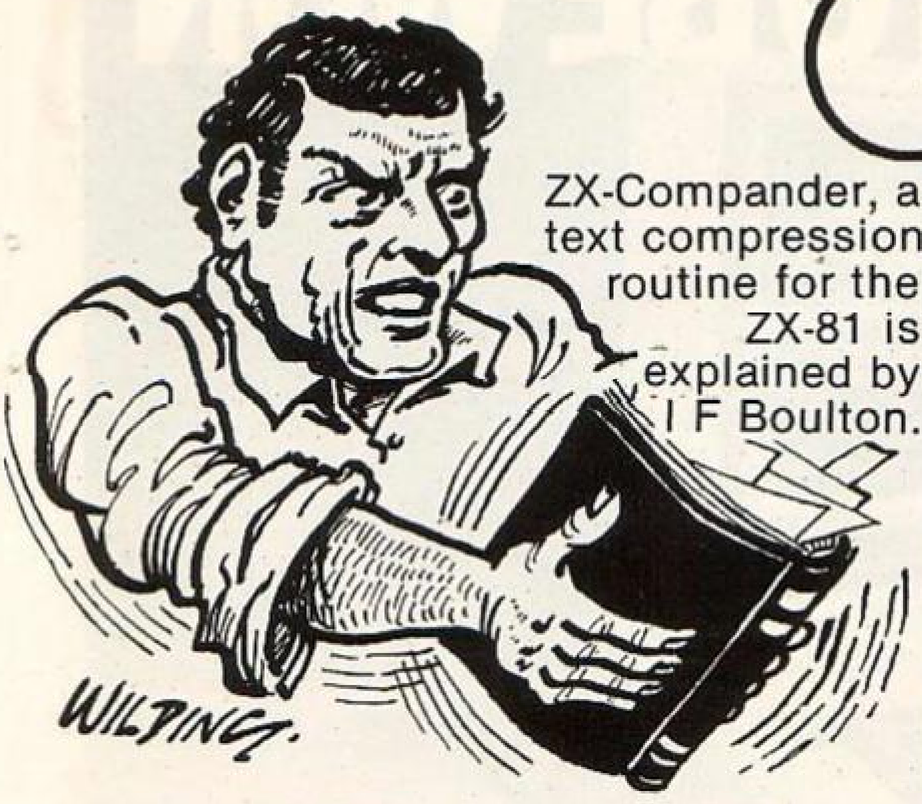
COMPRESSION OF TEXT FOR THE ZX-81

ZX-Compander, a text compression routine for the ZX-81 is explained by I F Boulton.



Listing 1.

```
   5 LET TOT=0
   9 REM **FOR LISTING 3 CHANGE
 16515,16614 TO 16621,16704
  10 FOR I=16515 TO 16614
  20 SCROLL
  30 PRINT I,
  40 INPUT J
  50 LET TOT=TOT+J
  60 POKE I,J
  65 PRINT J
  70 NEXT I
  80 IF TOT<>10191 THEN PRINT "E
RROR IN DATA INPUT"
  90 REM **FOR LISTING 3 CHANGE
 10191 TO 7612 **
```

EVEN WITH A 16K RAMpack the memory space of a ZX-81 is rapidly used up by programs containing large amounts of text. Adventure games and programs with Help messages or long instructions can often not be squeezed in at all. What is needed is a way of compressing text before storage so that it occupies much less memory space and then expanding just those sections required at a particular time, back to their original form.

Information can be compressed insofar as it is predictable; that is if we can find, for instance, sequences of letters that frequently occur in the text, we can code the whole sequence as one character each time it occurs. ZX-Compander works by storing certain pairs of characters in the message as single bytes. This method allows a maximum compression of 50 percent if all the message is composed of those pairs of letters which are being coded.

Each character recognised by the ZX-81 is stored as a single byte in memory. the non-inverted letters, numbers and most of the punctuation and arithmetic symbols have codes in the range 0 to 63. Thus of the 256 possible character codes 192 are not used in normal English, these codes are thus available for defining the pairs of letters we wish to encode.

ZX-Compander operates by searching through the text for any of the 18 characters stored in location 16514 to 16529, when one is found the next character is checked to see if it matches any of the 12 characters stored in locations 16514 to 16525.

If such a match is found the first character of the pair is replaced by a character whose code — in the range 64 to 255 — is calculated from the codes of the letters in the pair. The other member of the pair is then overwritten by the rest of the text being moved one character down in memory. This movement does not actually shorten the whole text string, it leaves the compressed text followed by a number of identical characters.

The character repeated at the end is the last character of the original text — this will in fact always be "$" — the number of repeats being equal to the number of times the message has been coded and moved down in the memory. Thus the text will be shortened by one character for every pair found, while the string remains the same length in memory. The actual compression occurs when the machine-code routine returns to Basic.

The BC register pair — whose contents is returned as the argument of the USR function — contains the length of the compressed text. The original string is thus shortened by a line of the form:

LET A$ = A$(TO USR 16621)

The reason why 16 characters are sought out initially and only a subset of 12 of these is accepted for the second member of the pair is that with only 192 (192=16*12) codes free we cannot uniquely represent 256 (256=16*16) pairs.

Listing 2.

16515	42	57	38	52	46
16520	51	56	45	55	41
16525	49	58	44	40	62
16530	237	91	16	64	27
16535	6	3	19	26	254
16540	13	32	246	16	246
16545	201	26	254	13	192
16550	19	26	27	254	13
16555	201	33	148	64	60
16560	71	43	16	253	126
16565	201	205	148	64	56
16570	123	64	71	5	40
16575	6	19	26	254	13
16580	40	247	24	248	19
16585	26	254	13	200	254
16590	64	56	19	245	230
16595	15	205	172	64	215
16600	241	203	63	203	63
16605	203	63	203	63	205
16610	172	64	215	24	225

The expansion section of the program reverses the above proceedure except that the decode result is printed directly onto the screen. This allows the whole memory to be filled with program and data without having to leave an indefinite amount of space available for holding decompressed text.

The compression which can be achieved using the program depends on the careful matching of the first 12 of the 16 characters to the text being coded — the last four have much less impact but are worth considering. The letters used in the listed program are the 12 most common letters in English — ETAOINSHRDLU — plus the space character and three other common letters — GCY. The space character is placed at the start of the list to speed the search as it is frequently the most common character in a text.

As your text may contain many numbers or symbols the program has been designed so that the only alteration needed to allow different sets of characters to be recognised is for the relevant character codes to be Poked into locations 16514 to 16529.

Another feature is that the character table and decoding routine are held in the first Rem while the encoding routine is held in the second. This allows you to delete the encoding routine once all the text has been compressed, freeing another 89 bytes of precious memory.

Beyond the restriction that your initial text cannot contain characters with codes over 63, there is one further problem; because the variables in the ZX-81 are moved about in memory by the machine's operating system it is necessary to flag the beginning and end of the text string so that the routines can recognise their data. This is done by starting

(continued on page 137)

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(continued from page 135)

the string with $$$, separating units within the text that need to be separately retrieved — up to a maximum of 256 items — with $ and terminating the data with $$. For this reason the $ sign may not be used casually in the text, and the $$$ sequence must not occur in other strings in the memory.

Start entering the program by typing a line 1 REM followed by a single space and then 100 zeros and a line 2 REM followed by 84 zeros. The machine-code loader in listing 1 can then be typed in and Run. Carefully enter all the decimal codes in listing 2, addresses are given for every fifth byte to help you check your input.

Then edit line 10 to read

FOR I = 16621 TO 16704

and Run the program again, this time entering the codes in listing 3. This should give you two Rems identical to those shown in listing 4. If all is well delete the loading program and enter the Basic lines from listing 4. It is wise to save the program now before running it, as any mistakes in the machine code will crash the machine.

If there are any mistakes in the routines corrections can be Poked into the Rems; any attempt to Edit them will probably corrupt the code.

The program can now be Run. When prompted enter any string you choose which obeys the rules on allowable characters. If you wish you can separate sections within the text with $ signs. After you hit Newline the text will be encoded. You will then be asked for the item number you require.

This will normally be 1 unless you have put $ separaters in the text. If you enter an item number which does not exist the program will crash.

The item you have requested will now be printed starting at the first free print position on the screen. If the original text is not recovered or the program crashes the routine must be carefully checked using Peek. Once everything is working smoothly you can proceed to use the routines in application programs.

As the routine adds five bytes of $ to the message, plus one byte for each separater, the greatest compression will only be achieved on relatively long sections of text. The routines typically achieve compressions of 30 to 40 percent on a wide range of input, from this and the amount of memory occupied by the decoding routine — 104 bytes — it can be seen that savings in overall memory usage begin to appear when the text is over about 300 characters long. Although the compressed string actually appears longer this is due to certain codes appearing as keywords.

In general your final application program should be developed by first loading the ZX-Compander routines from tape, adding in Basic whatever editing facilities you need to aid the input of your text, entering the text and then compressing it using a line like line 30 in listing 4. Once this has been done the editing section and line 2 can be deleted. When you need to print an item all that is required is that the item number be Poked into 16507, the print position be specified using Print At and the routine called using Rand USR 16566.

The routines are not relocatable due to the numerous subroutine calls using absolute addresses.

Listing 3.

16621	205	148	64	19	205
16626	162	64	40	60	33
16631	130	64	26	6	16
16636	190	40	5	35	16
16641	250	24	236	5	197
16646	19	33	130	64	26
16651	6	12	190	40	6
16656	35	16	250	193	84
16661	219	120	198	3	79
16666	6	15	129	16	253
16671	193	128	71	16	211
16676	19	66	75	19	26
16681	2	205	162	64	32
16686	248	209	24	190	205
16691	148	64	6	0	14
16696	4	3	19	205	182
16701	64	32	249	201	

Listing 4.

```
   1 REM  ETAOINSHRDLUGCY GOSUB
?(RAND.[illegible] RETURN $4 SAVE ! SAVE
 TAN  RETURN $ [illegible] RETURN $TAN
 [illegible]NDU?F( CLEAR TAND?[illegible] RETU
RN $C RUN / SAVE <, RETURN [illegible]
RETURN RND$: PRINT NEW ?LN [illegible]
OT LET ACS ZACS ZACS ZACS ZLN [illegible]
NDNOT / LPRINT
   2 REM LN [illegible]RND:LN [illegible]RNDCUS[illegible]RND,
[illegible]7: IF / GOTO [illegible]VAL ([illegible]RND [illegible]
[illegible]7( IF AT /(=?LEN [illegible] CLEAR
 AT [illegible].)STR$ (PI?),[illegible]LN [illegible]RND4 PLOT
 SGN /[illegible]LN [illegible]RND[illegible]LN [illegible]RND4 RAN
D TAN
   5 REM [illegible]
   6 REM [illegible]
   7 REM [illegible]
   8 PRINT "[illegible]"
  10 INPUT A$
  20 LET A$="$$$"+A$+"$$"
  25 LET LENGTH=LEN A$
  30 LET A$=A$( TO USR 16621)
  40 REM [illegible]
  50 PRINT "ENTER TEXT ITEM NUMB
ER"
  60 INPUT J
  70 POKE 16507,J
  80 RAND USR 16566
  90 PRINT
 100 PRINT "COMPRESSED BY ";100-
(100*LEN A$/LENGTH);" 0/0"
 110 STOP
```

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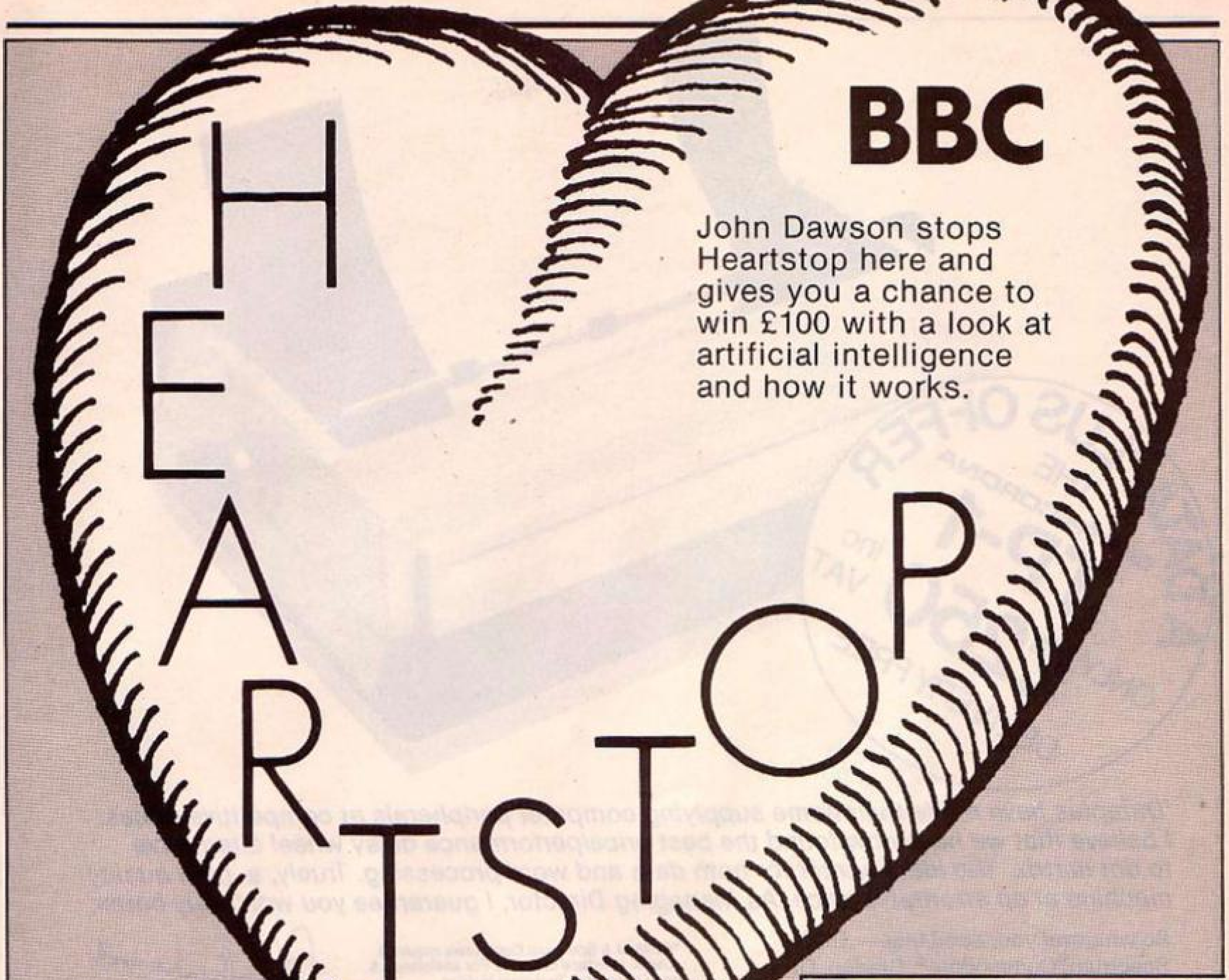

BBC

HEARTSTOP

John Dawson stops Heartstop here and gives you a chance to win £100 with a look at artificial intelligence and how it works.

COMPUTERS ARE capable of the most complex calculations and control operations. And yet the pictures in a child's story book are beyond interpretation by machines. By contrast to the traditional approach in which predefined steps are followed to solve a problem — a Basic program, for example — artificial intelligence work is said to be about "problem solving programs that solve substantial problems generally conceded as being difficult and requiring expertise."

There is a fair amount of confusing about some of the terms used in artificial intelligence — AI — so here are some difinitions from a Dictionary of Information Technology:

"Artificial Intelligence. Research and study into methods for the development of systems thatcan demonstrate some of those attributes associated with human intelligence, eg., the ability to recognise a variety of patterns from various viewpoints, the ability to form hypotheses from a limited set of information, the ability to select relevant information from a large set and draw conclusions from it.

"Expert systems. In databases, systems containing a database and associated software that enable a user to conduct an apparently intelligent dialogue with the system in a user oriented language.

Artificial intelligence

"Heuristic. In problem solving, a trial and error approach involving successive evaluations at each step made in the process of reaching the final result. In contrast, an algorithm represents a consistent approach in arriving at an optimal result."

Alan Turing, one of the first people to work on the theory of computers, devised a test which illustrates practically what is meant by the term "artificial intelligence": Put a person in a room with a teleprinter connected to a remote computer. Allow the person to type questions on to the teleprinter and if he is unable to decide whether or not he is communicating with a person or a machine then the machine exhibits artificial intelligence.

So artificial intelligence consists, chiefly, of representing facts and "rules of thumb" — heuristic search techniques — in a computer and of manipulating them, by a process analogous to human reasoning, in order to achieve specified goals.

Expert systems have to contain three fundamental elements: a knowledge manager — the inference engine, a knowledge base — the 'database' in the definition above, and a situation model. Normally the knowledge manager employs the information in the knowledge base to interpret what is going on at the time in the situation mode. In relation to Heartstop, for example, the knowledge base would contain reference information about:

- The number of beds in the hospital.
- The types of medical care that can be given e.g. surgery, children's medicine, orthopaedics — surgery on bones, psychiatry, accident and emergency.
- The names and quantitites of the drugs kept in the pharmacy.
- How many nurses are necessary to cover each of the wards.
- Procedures to be followed in the event of a major accident, a key member of staff going off sick, fire in the hospital, mains electricity failure and so on.

(continued on page 141)

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(continued from page 139)

The situation model might contain changing information on the following lines:

- How many patients are in the hospital at present?
- How many operating theatres are ready for use?
- How many nurses are on duty and on which wards?
- The drugs curently being prescribed for each patient.

You can see that the knowledge base contains the fixed information that describes the hospital and its capabilities. The more complete the knowledge base can be made, the easier the task of the inference engine becomes.

The situation model has to interact with the outside world, reflecting the current status of the operating theatres, and the level of staffing throughout the hospital.

An alternative approach to the defined knowledge base of the expert rule systems uses statistics to predict a probable cause of an event. Thomas Bayes, a fellow of the Royal Society of London, formulated his theorem about the probabilities of events in 1760. Bayes Theorem is used to incorporate information into a decision analysis approach to a problem. The theory can be related to an enormous diversity of problems one of which is medical diagnosis and the refinement of clinical tests.

Suppose that you see a young adult male patient in the Accident and Emergency Department. Before your examination you will have some idea of the probable causes of acute abdominal pain in young adults. If you discover that pain is most severe in the right lower quadrant and that it is made worse by movement your suspicion that the cause is acute appendicitis will be increased.

Your estimate of the probability of the pain being caused by an acute appendicitis has been altered by your tests and observations and this now appears the most likely cause.

The prior probability — the chances of acute appendicitis at the time you were bleeped but before you had examined the patient — has been modified by the event of you performing some clinical tests to give a posterior probability at the end of your examination. Immediately that posterior probability of the patient's condition being due to acute appendicitis becomes the prior probability for the next event; along with the other altered probabilities for all the other causes that you considered.

You decide to operate on the young man and successfully remove an enlarged and inflamed appendix. The pathology report confirms your diagnosis and the final posterior probability for this case approaches a certainty that the cause of the pain was due to the diseased appendix.

Tim de Dombal, a surgeon in Leeds, has collected the structured results of thousands of cases of acute abdominal pain through a world-wide network of doctors.

Tim de Dombal uses a newish Commodore microcomputer which sits quietly and unaggressively in one corner of an office. The results of about six thousand cases of acute abdominal pain were entered into a survey and a computer program was developed which would carry out a Bayesian analysis to prepare a set of prior probabilities for the causes of acute abdominal pain in a particular patient. The program is perhaps a couple of hundred lines of Basic in length.

Figure 1.

```
 10 FLAG$ = STRING$(36," "): FLAN$ = "RESET"
 20 FLAG$ = ""
 40 REPEAT
 50   CLS
 60   PRINT "Set, Reset, or Test a flag"
 70   PRINT: PRINT "Current flags are: ";FLAG$
 80   REPEAT
 90     K$ = INKEY$(1)
100     UNTIL K$ <> ""
110   IF K$ = "S" OR K$ = "s" THEN PROCsetflag
120   IF K$ = "R" OR K$ = "r" THEN PROCresetflag
130   IF K$ = "T" OR K$ = "t" THEN PROCtest
140   UNTIL K$ = "Q" OR K$ = "q"
150 END
170 DEF PROCsetflag
180 PROCinputflag
190 PROCtestflag (FL$)
200 IF FLAN$ = "SET" THEN ENDPROC
210 FLAG$ = FLAG$ + FL$
220 ENDPROC
240 DEF PROCtest
250 PROCinputflag
260 PROCtestflag (FL$)
270 PROCprintresult
280 ENDPROC
300 DEF PROCtestflag (FL$)
310 POSITION% = INSTR(FLAG$,FL$)
320 IF POSITION% = 0 THEN FLAN$ = "RESET" ELSE
FLAN$ = "SET"
330 ENDPROC
350 DEF PROCresetflag
360 PROCinputflag
370 PROCtestflag (FL$)
380 IF FLAN$ = "RESET" THEN ENDPROC
390 TEMP1$ = LEFT$(FLAG$,(POSITION%-1))
400 TEMP2$ = RIGHT$(FLAG$,(LEN(FLAG$)-POSITION%))
410 FLAG$ = TEMP1$ + TEMP2$
420 ENDPROC
440 DEF PROCprintresult
450 PRINT TAB(10,17);FLAN$
460 FOR DELAY = 1 TO 2000: NEXT DELAY
470 ENDPROC
490 DEF PROCinputflag
500 PRINT TAB(10,10);"Input flag ";
510 FL$ = GET$: PRINT FL$
520 ENDPROC
```

Tim de Dombal has written that: "in the 1476 cases of appendicitis, the computer aided prediction matched the final diagnosis in 84 percent. In many centres the accuracy of match was higher — around 90 percent. This relatively high accuracy of match is less informative about the computer that about acute appendicitis. We concluded that acute appendicitis presents in roughly the same fashion around the world, and is a disease entity which presents in a broadly similar fashion to clinicians in a variety of centres."

Helping with decisions

However, the paper's conclusions continued "Turning to other diseases, such as acute cholecystitis, perforated peptic ulcer and small bowel obstruction, very similar conclusions emerged. Overall, and in the overwhelming majority of individual centres, there was a high (>80) percent of match between the computer's diagnostic prediction and the actual diagnosis made in the centre concerned."

In this application, a computer is helping doctors to make better decisions about patient care; it is not making the decisions itself.

Heartstop, like most other programs need to record that something has happened, or mark that a particular "thing" is on or off. Flags are used to store the current state of the "thing". A flag is a programming device that can be set on or off — the flag is up or down, it's not allowed to be at half mast. In Slagthorpe Memorial Hospital, for example, you may want to record whether or not a patient has had an ECG examination, or mark the patient's notes to show that the patient has died or been discharged home.

I have set the surgical scene and given you a helping hand with the program. Now it's up to you — you're on your own. Finish the program in your own way and send it to Heartstop, Room L213, Quadrant House, The Quadrant, Sutton, Surrey. The best entry received by the end of April will get a £100 prize and a chance of publication in the magazine.

The patient summary can then be made to print only those patients known to be in the hospital, while retaining the whole list of patients who have been "treated" during the weekend in order that it can be printed at the end of the game.

On way of creating flags in Basic is to use an integer variable, or an integer array, to hold the numbers one or zero, representing the flag's on or off state. As each integer variable takes up four bytes that is a pretty inefficient method. The ideal answer is to use machine code where a single bit can be turned on and off, allowing you to store eight flags in a single byte. The Z80 cpu is better equipped than the 6502 for this sort of 'bit-twiddling'.

The 6502 cpu in the BBC machine can only test the most significant bit in a byte, although the problem can be overcome very easily by rotating the bits until the one you wish to operate on is at the most significant position. However, while the BBC micro has a super built-in assembler, it is a lot of bother to drop into it just for this purpose.

Figure 1 is a test program that shows another way of storing and using flags that takes up only one byte for each flag and gives you additional information about when the flag was set in relation to other flags.

The INSTR instruction — page 280 BBC Microcomputer User Guide — searches one string for the occurrence of another. You can use a single letter to represent a Flag-On condition and the absence of that letter to represent the Flag-Off condition. There is a small space penalty in setting up the string in the first place but after that each additional flag occupies just one byte.

The 36 alphanumeric characters 0 to 9 and A to Z can be used as unique indentifiers. Setting a flag is easy — lines 170 to 220. The test program includes a procedure — PROCinputflag — to get the flag you wish to set from the keyboard. If you wish to use these routines in another program just delete the PROCinputflag lines, and add the parameter — FL$ — on to the definition of the two procedures — lines 170 and 350. Calling PROCsetflaf (B) will then add "B" to the existing FLAG$ string. The condition of a flag can be tested by PROCtestflag (FL$). PROCtest is included simply to show the result of the test on screen.

INSTR returns a value of zero if the substring FL$ is not found in the main string. Note that both Flan$ and Position% are global variables and these are used in the next procedure — PROCresetflag — and to reset a flag to the Off stage.

The collection of flags in Flag$ is split into two on either side of the flag found in PROCtestflag and then recombined. The flag identified in FL$ is no longer present in Flag$ and has been reset. Because a flag is always added to the end of the string when it is turned on the time sequence in which events take place can be determined by finding the position of each flag in Flag$ using the INSTR instruction. ■

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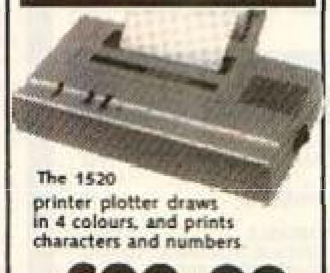

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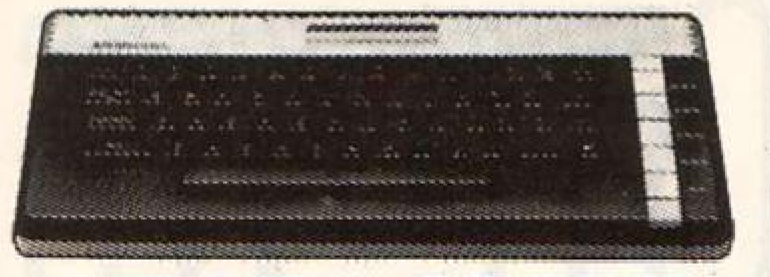

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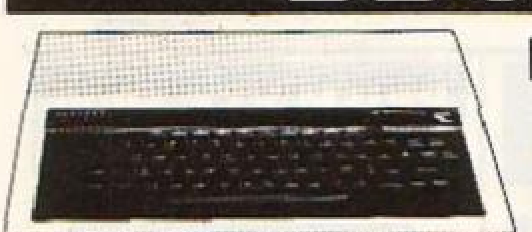

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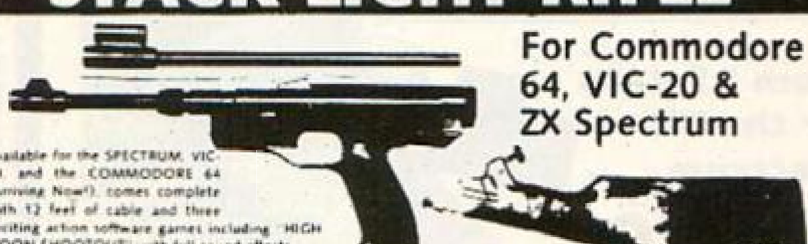

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W1 Computers of Wigmore St., 87 Wigmore
St. Tel: (01) 486 0373
W1 GK Photo & Computers, 92-94 Wardour
St. Tel: (01) 437 0182
W1 Devron, 4 Edgware Rd.
Tel: (01) 724 2373
W1 Sonic Foto & Micro Centre, 256
Tottenham Court Rd. Tel: (01) 580 5826
W1 Computer Plus, 219 Regent St.
Tel: (01) 437 1071/4
W7 TK Electronics, 11/13 Boston Rd.,
Hanwell. Tel: (01) 579 2842
WC2 City Camera Exchange, 115 Kingsway
Tel: (01) 405 0446

MANCHESTER GREATER

BOLTON Wilding Ltd., 23 Deansgate.
Tel: (0204)33512
HYDE Pase, 213-215 Market St.
Tel: (061) 366 5935
MANCHESTER Lomax Ltd. 8 Exchange St.
St. Ann's Square. Tel: (061) 832 6167
OLDHAM Home & Business Computers Ltd.,
54 Yorkshire St. Tel: (061) 6331608
ROCHDALE Home & Business Computers,
75 Yorkshire St. Tel: (0706) 344654
SWINTON Mr Micro Ltd., 69 Partington
Lane. Tel: (061) 728 2282
Late Night Friday
WIGAN Wilding Ltd., 11 Mesnes St.
Tel: (0942) 44382

MERSEYSIDE

BIRKENHEAD Fairs Cameras & Hi-Fi, Dacre
Hill, Rock Ferry. Tel: (051) 645 5000
HESWALL Thornguard Computer Systems,
46 Pensby Rd. Tel: (051) 342 7516
HUYTON Ian Houghton 5 Huyton Hey Rd.
Tel: (051) 489 5785
LIVERPOOL Beaver Radio, 20-22 Whitechapel. Tel: (051) 709 9898
LIVERPOOL (Aintree) Hargreaves, 31-37
Warbreck Moor. Tel: (051) 525 1782
SOUTHPORT Central Computers, 575 Lord
St. Tel: (0704) 31881
ST HELENS Studio 55, 55 Ormskirk St.
Tel: (0744) 39496

MIDDLESEX

EDGWARE Breaker 1-4, 130 High St.
Tel: (01) 952 7488/8860
HARROW Camera Arts, (Micro Computer
Division) 24 St Annes Rd.
Tel: (01) 427 5469
HAYES Chipstop, 1000 Uxbridge Rd.
Tel: (01) 573 2511
STAINES Snapmarket, (In store at House of
Holland) Clarence St. Tel: (0784) 63847
TEDDINGTON Andrews, Broad St.
Tel: (01) 977 4716
UXBRIDGE J K L Computers, 7 Windsor St.
Tel: (0895) 51815

NORFOLK

FAKENHAM Fastview, 12 Norwich Rd.
Tel: (0328) 51319
NORWICH Sound Marketing, 52 St.
Benedicts St. Tel: (0603) 667725
THETFORD C B & Micros, 21 Guildhall St.
Tel: (0842) 61645

NORTHAMPTONSHIRE

NORTHAMPTON Dormans, 22 Princes Walk
Grosvenor Centre. Tel: (0604) 37031

NOTTINGHAMSHIRE

NOTTINGHAM Cameo Computer, 8/9/10
Trinity Walk. Tel: (0602) 742912
NOTTINGHAM Jacobs Computers. 13
Middlegate Newark. Tel: (0636) 704873
(Just Opening)
WORKSOP Computergraphix, 132 Bridge
St. Tel: (0909) 472248

NORTHERN IRELAND

BLEFAST Arthur Hobson Ltd., 37 Great Victoria St. Tel: (0232) 246336
CO ARMAGH Pedlows, 16 Market St.,
Portsdown Craigavon. Tel: (0762) 332265
LONDONDERRY Foyle Computer Systems,
3 Bishop St. Tel: (0504) 268337
NEWRY Newry Computer Centre. 34
Monaghan St. Tel: (0693) 66545

OXFORDSHIRE

ABINGDON Ivor Fields Computers, 21 Stert
St. Tel: (0235) 21207
BANBURY Computer Plus, 2 Church Lane.
Tel: (0295) 55890
HENLEY-ON-THAMES Family Computers
Ltd., 40A Bell St. Tel: (0491) 575744
OXFORD Ivor Fields, 7 St Ebbes St.
Tel: (0235) 21207

SCOTLAND

ABERDEEN North East Computers, 1-3 Ellis
St., Peterhead. Tel: (0779) 79900
AYR Vennals, 6A New Bridge St.
Tel: (0292) 264124
DUMFRIES Vennals, 71 English St.
Tel: (0387) 54547
EDINBURGH The Silicon Centre,
6-7 Antigua St. Tel: (031) 557 4546
GLASGOW Victor Morris Ltd., 340 Argyle St.
Tel: (041) 221 8958
HAMILTON Tom Dickson Computers, 8-12
Cadzow St. Tel: (0698) 283193
KILMARNOCK Vennals, 49 Foregate.
Tel: (0563) 32175
KIRCALDY Kirkaldy Photographic Services,
254E High St., Fife. Tel: (0592) 204734
STIRLING R Kilpatrick, 58 Port St.
Tel: (0786) 5532

SHROPSHIRE

SHREWSBURY Computerama, 13 Castlegate. Tel: TBA
TELFORD Computer Village. 4 Hazeldine
House Telford Town Centre. Tel: (0952)
504666

SOMERSET

TAUNTON Grays, 1 St James St.
Tel: (0823) 72986

STAFFORDSHIRE

STAFFORD Computerama, 59 Forgate St.
Tel: (0785) 41899
STOKE-ON-TRENT Computerama, 11 Mkt
Square Arcade Hanley. (0782) 268620

SUFFOLK

BURY ST EDMUNDS Bury Computer
Centre, 11 Guildhall St.
Tel: (0284) 705772
FELIXSTOWE KM Communications Ltd.,4
Manning Rd. Tel: (0394) 271113/273459
IPSWICH Brainwave, 24 Crown St.
Tel: (0473) 50965
LOWESTOFT John Wells, 44 London Rd
North. Tel: (0502) 3742

SURREY

CAMBERLEY Camera Arts (Micro Computer
Division), 36 High St. Tel: (0276) 65848
CHERTSEY Chertsey Computer Centre, 1
Windsor St. Tel: (09328) 64663
CROYDON Classic Cameras 16 St. Georges
Walk. Tel: (01) 686 2012
FRIMLEY Micro & Telex Services Ltd., 105
Mytchett Rd. Tel: (0252) 513282/513215
HASLEMERE Haslemere Computers, 25
Junction Pl. (Adj. Rex Cinema)
Tel: (0428) 54428
NEW MALDEN Surrey Micro Systems, 31
High St. Tel: (01) 942 0478
RICHMOND Crest Computer Services, 8 Hill
St. Tel: (01) 940 8635
WALLINGTON Surrey Micro Systems Ltd.,
53 Woodcote Rd. Tel: (01) 647 5636
WOKING Harpers, 71-73 Commercial Way.
Tel: (04862) 25657

SUSSEX

BEXHILL-ON-SEA Computerware, 22 St
Leonards Rd. Tel: (0424) 223340
CRAWLEY Gatwick Computer Services, 62
Boulevard. Tel: (0293) 37842
LITTLEHAMPTON Allan Chase Ltd., 39 High
St. Tel: (09064) 5674

TYNE & WEAR

NEWCASTLE-ON-TYNE Newcastle Camera
& Computer Mart, 16 Northumberland Court.
Tel: (0632) 327461

WALES

ABERDARE Inkey Computer Services Ltd.,
70 Mill St. The Square Trecynon.
Tel: (0685) 881828
ABERTSTWYTH AberData at Galloways, 23
Pier St. Tel: (0970) 615522
CARDIFF Randall Cox, 18-22 High St
Arcade. Tel: (0222) 31960
LLANDUDNO (Gwynedd) Computer Plus
Discount, 15 Clonmel St. Tel: (0492) 79943
NEWPORT (Gwent) Randall Cox, 118
Commercial St. Tel: (0633) 67378
PEMBROKE Randall Cox, 19 Main St.
Tel: (064) 682876
PORT TALBOT Micro Gen, 6 Royal Buildings
Talbot Rd. Tel: (0639) 887730
WREXHAM T E Roberts, 26 King St.
Tel: (0978) 364404/364527

WARWICKSHIRE

LEAMINGTON SPA IC Computers. 43
Russell St. Tel: (0926) 36244
RUGBY The Rugby Micro Centre, 9-11
Regent St. Tel: (0788) 70522

WEST MIDLANDS

BIRMINGHAM Sherwoods, Gt Western
Arcade. Tel: (021) 236 7211
COVENTRY Greens, 22 Market Way.
Tel: (0203) 28342
DUDLEY Central Computers, 35 Church Hill
Precinct. Tel: (0384) 238169
ERDINGTON The Gamekeeper Grand Fare,
High St. Tel: (021) 384 6108
WEST BROMWICH Bell & Jones, 39 Queens
Square. Tel: (021) 553 0820

WILTSHIRE

SALISBURY Whymark Computer Centre, 20
Milford St. Tel: (0722) 26688

WORCESTER

KIDDERMINSTER Central Computers, 20-21 Blackwell St. Tel: (0562) 746941
WORCESTER David Waring Ltd., 1 Marmion
House High St. Tel: (0905) 27551

YORKSHIRE

BRADFORD Erricks, Fotosonic House Rawson Square. Tel: (0274) 309266
DEWSBURY Home & Business Computers.
59 Daisy Hill. Tel: (0924) 455300
DONCASTER The Soft Centre 8 Queensgate Waterdale Centre Tel: (0302) 20088
HUDDERSFIELD Richards (Formerly
Lauries) 12 Queen St. Tel: (0484) 25334
LEEDS Bass & Bligh, 4 Lower Briggate.
Tel: (0532) 454451
SHEFFIELD Superior Systems Ltd.,
178 West St. Tel: (0742) 755005
YORK York Computer Centre 7 Stonegate
Arcade. Tel: (0904) 641862

Not all stores carry every advertised item, please phone before making a journey - prices correct at time of going to press E&OE

IN THE WAKE OF CHRISTMAS

EVEN MY next-door neighbour knew about it. Youngsters were worried about it. What? The Christmas computer famine. TV reports propagated the idea of a shortage of home computers for the big rush at Christmas.

Many shops did indeed run out of the top selling models, but they do not plan on having huge stocks left on Christmas Eve. Most computers could still be bought then at quite a few of the main outlets.

So where did the rumour start? The first I heard of the shortage was early December, on an evening TV news program. They reported that the Commodore Vic factory was working night shifts to satsify demand. This practice seems unlikely to have any real effect on the supply problems, as any components would have to be ordered well in advance, and there were only a couple of weeks left to move the units from the end of the production line into the high street stores.

Human nature being what it is, one whiff of a shortage will prompt an increase in demand; an artificial adjustment to the normal balance of supply and demand. I know that computers are not quite the same as consumables such as sugar or petrol, both of which have been affected by scares of shortages, but an alarming effect on the Christmas shopper can be caused by a minor mis-judgment of the situation.

Some computers, especially the new Electron, were not available in the quantities hoped, but others seemed to make up for it. Most youngsters do not expect to "take a rain-check" from Santa though, so maybe the retailers and manufacturers who have stock on the shelves would happily encourage an available alternative computer into their stockings.

With 1983 being the year of the home computer, who could afford to miss out on the stampede at Christmas?

With the Spectrum being one of the top selling computers last Christmas, it was not surprising that Sinclair waited until the New Year to announce the QL — Quantum Leap — "business" computer. With a £400 price tag it will be a winner, but surely not the threat to the conventional business computer that is being suggested? The advanced home user/enthusiast must be the main market, though with the on-board software it could be very attractive as an executive workstation.

Most business micro's are still being bought for one function; possibly inventory control, payroll or word processing. Apart from, perhaps, word-processing, the computer may spend much of its time switched off, and therefore not earning its keep. This is where a program such as VisiCalc, one of the most popular spreadsheets, comes into its own. The great advantage of this sort of program is that the user specifies the function; that is, it does not have any predetermined purpose.

A spreadsheet is simply a piece of paper in the computer's memory. This piece of paper has both horizontal and vertical lines on it, giving rows and columns of "boxes". Each box can be given a numeric value, text or a formula. Confused? Let us take an example. Say I am responsible for setting retail prices for a number of computer items. Retail price is dependant on cost price which is affected by currency exchange rates. The gross profit margin is important too.

On paper I would have to calculate a cost price for each item using a fixed exchange rate. By using a calculator I can now try a few selling prices until the profit margin is acceptable. Repeat this for 200 items and my eyes cease to focus successfully, and the ends of my fingers are numb.

There must be an easier way. On the spreadsheet program I design a sheet which has columns for product number, cost price, currency, selling price and profit margin. All I have to do is decide which formulas need to be built into the sheet. First is the currency conversion; all I type is something like "column 3 equals column 1 divided by column 2". Then we need the profit margin calculation which is entered in a similar way. Tell the sheet to repeat these formulas for every item and we are ready to enter some data.

As soon as a figure is entered, the system performs any related calculation for you. When all the costs have been typed in, I can enter some selling prices, and see what the profit margin looks like. I can try as many retail prices as I like; the system will obediently return a profit margin.

When all the figures have been entered the fun is still not over. Now for the real magic! What if the currency rate changes? Type in a new value for a currency, and all the affected costs will change automatically, and the profit margin will be updated also. Try as many what ifs as you need, and maybe print them out as a record.

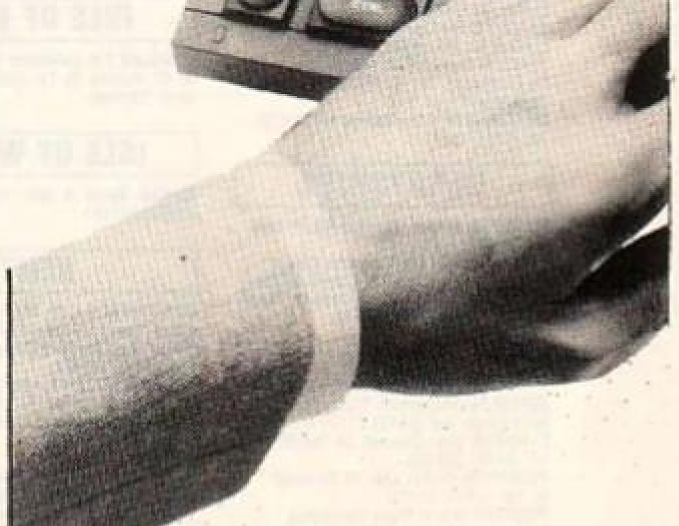
Another long awaited new arrival was officially announced last November. The IBM stork proudly showed off the latest member of the PC family; the IBM PC Junior or PCjr. Months of press speculation had been thwarted by the company, both in the specification and the name. Peanut had been quoted as the title for the new machine, and stories had flourished of how the famous cartoonist had been commissioned to create a series of advertisements for IBM based on his Peanuts and Snoopy characters.

Contradicting most of the pre-release reports, the PCjr was not a portable version on Sinclair lines. This computer seems to be aimed at the education sector and upmarket home user. It will sell for about $670 — £500 — for the 64K RAM cassette-based unit and $1,270 — £930 — for the single disc drive model with 128K.

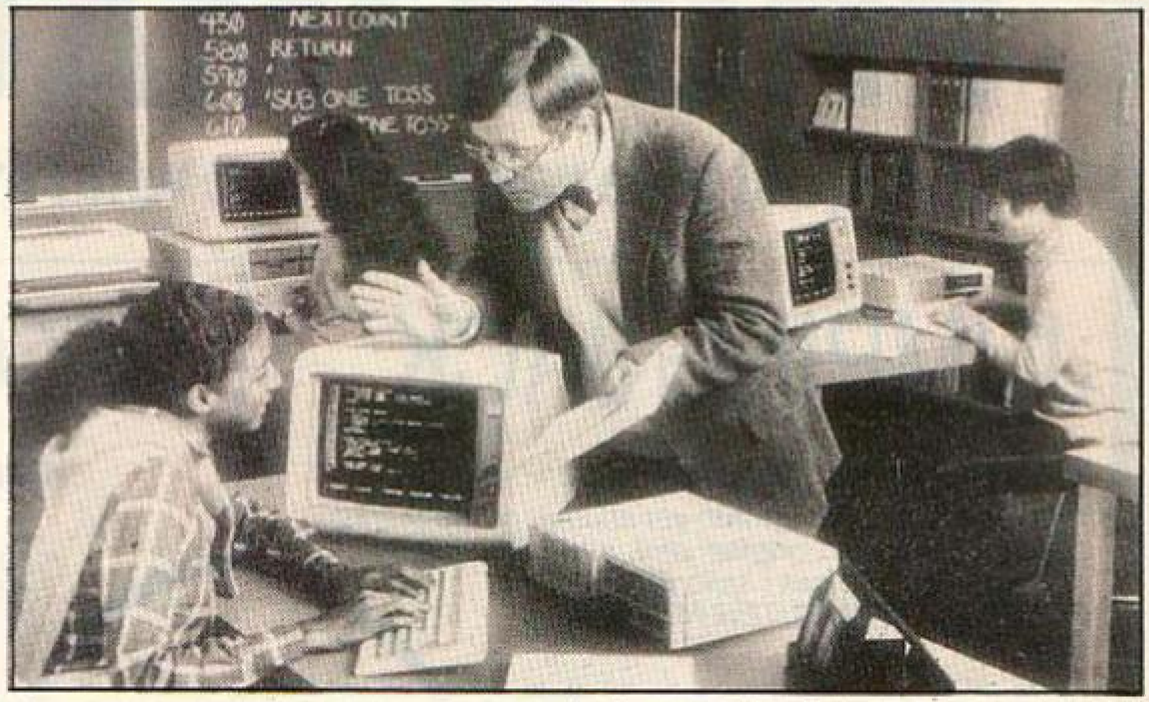
With the usual conversion of dollar prices to pounds, the English version of the 64K PCjr could be around £560 including VAT, or £1,230 including VAT for the disc model. You will still need a monitor; either the IBM colour display at £500 or a suitable television

For home entertainment or for the enthusiast the IBM PCjr seems a little pricey, and the extended version with disc drive and colour monitor is competing with some of the British machines like the Apricot. They may have included a wealth of features, but for the British market the price tag may be a little prohibitive. IBM has aimed this machine at the American public, with its higher disposible income, and probably have not even considered the British market.

The IBM PCjr was not one of the machines being shown at this year's *Which Computer?* exhibition. Many other new models were being previewed, with a number of Japanese companies including Fujitsu, Canon and Sanyo unveiling IBM like Personal



Martin Soble looks at the "computer famine", the "chip shortage" and the latest in micro hardware as well as the recent RITA awards.



Computers, but it was pleasing to see some new British designed and manufactured computers being well received.

In keeping with most computer exhibitions, the battle for the public's attention was on. Companies planned a variety of distractions, from the usual pretty girls wearing the least decently possible, to free wall charts or glasses of Saki. Some of the biggest stands were for IBM, ACT, Apple and Digital, each with an attractive display of its range of products.

IBM installed one of its minicomputer/mainframe computers which looked rather archaic, while ACT concentrated on the Apricot. Apple pushed the Lisa, but with the £5,000 price ticket, it will have to push a lot harder to make a real impact.

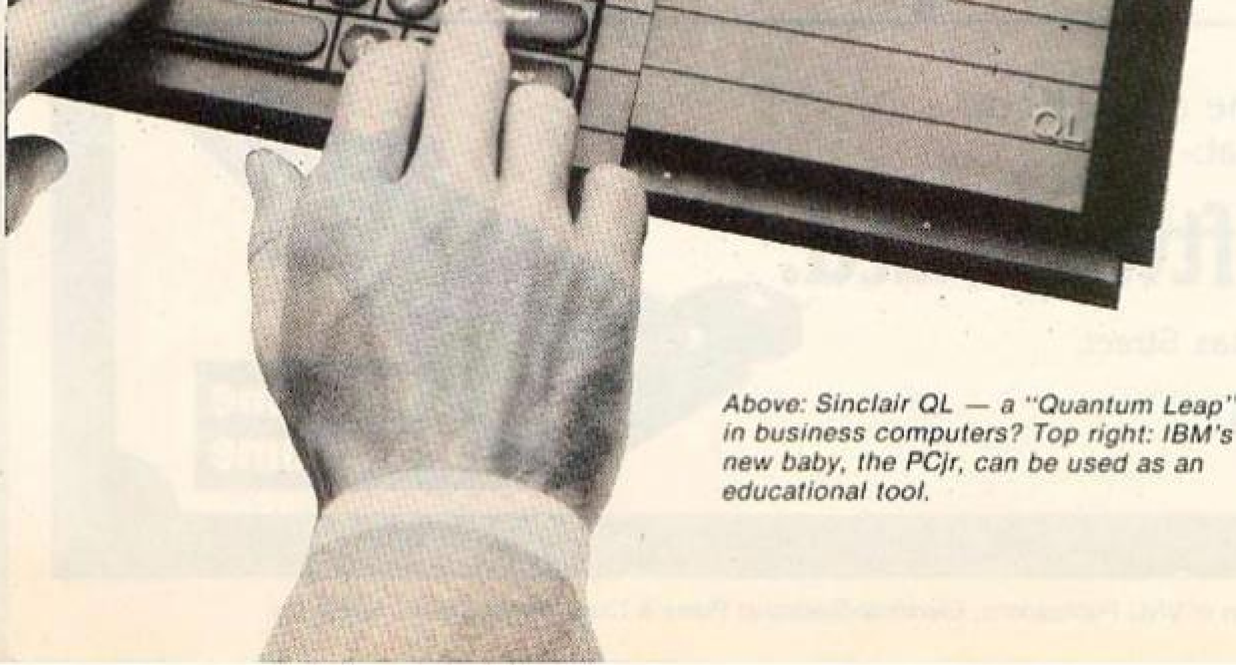
The organisers of the *Which Computer?* show, Clapp and Poliak Europe Ltd. are also main sponsors of the Recognition of Information Technology Achievement awards. RITA awards are to the computer world that Oscars are to the film industry.

The awards were presented by Ian McNaught Davis, a familiar television personality as a presenter of *The Computer Programme,* who gave a keynote speech with an interesting anecdote about the BBC and its "non-commercial" standing. Mr Davis joked about calling the programmes "Learn to program and make a million pounds" which did not impress the Beeb, who ended up with a microcomputer bearing its name, and reportedly making a million for the manufacturers, Acorn Computers!

Individual awards were sponsored by various computer magazines, each of which put a representative on to the judging panel and gave a short introduction to each of the nominations. A fanfare heralded the opening of each envelope revealing the winner's name, followed by applause and the lucky person fighting their way over tables and chairs to reach the stage. The happy recipient then said a few words praising his team and thanking the judges for the award.

One RITA award winner who was not available to receive his statuette in person was Hermann Hauser, one of the joint managing directors of Acorn Computers. The "Personality of the Year" award winner was reported by his wife to be still in Japan securing supplies of chips, the silicon kind that is, presumably for the Electron and BBC computers. Many companies are worried about the impending world chip shortage.

The problem is that some two or three years ago, there was a surplus capacity of chips. As often happens in a growing industry, manufacturers had over estimated the demand, and were capable of making far too many of some types of chips, particulary RAMs. Once the commitment had been made to the expensive capital machinery that churns out these devices by the thousand, the production lines had to be kept moving, and of course, prices fell. Good for the consumer, but once the manufacturer realised that there was no profit to be made, they cut back on investment. Three years later, demand for chips is at an all time high, but now the insufficient capacity at the manufacturing level will hold prices up and restrict the production of some computers, especially those made in the Far East.



Above: Sinclair QL — a "Quantum Leap" in business computers? Top right: IBM's new baby, the PCjr, can be used as an educational tool.

Another problem for the industry is the production of the central processing unit chips, especially the latest 16 bit family devices. Early production of any chip gives a low yield and a high failure rate. This is a headache for the computer manufacturers who want ready supplies of reliable chips. Cpus like the 80186 used in the new Tandy 2000 are being rationed by the manufacturer, Intel, in America.

This chip is the heart — or brain — of the computer, so no amount of redesigning of the circuits will help. Companies like IBM seem to be taking an interest in the major chip makers, perhaps with the idea of keeping a finger on their pulse.

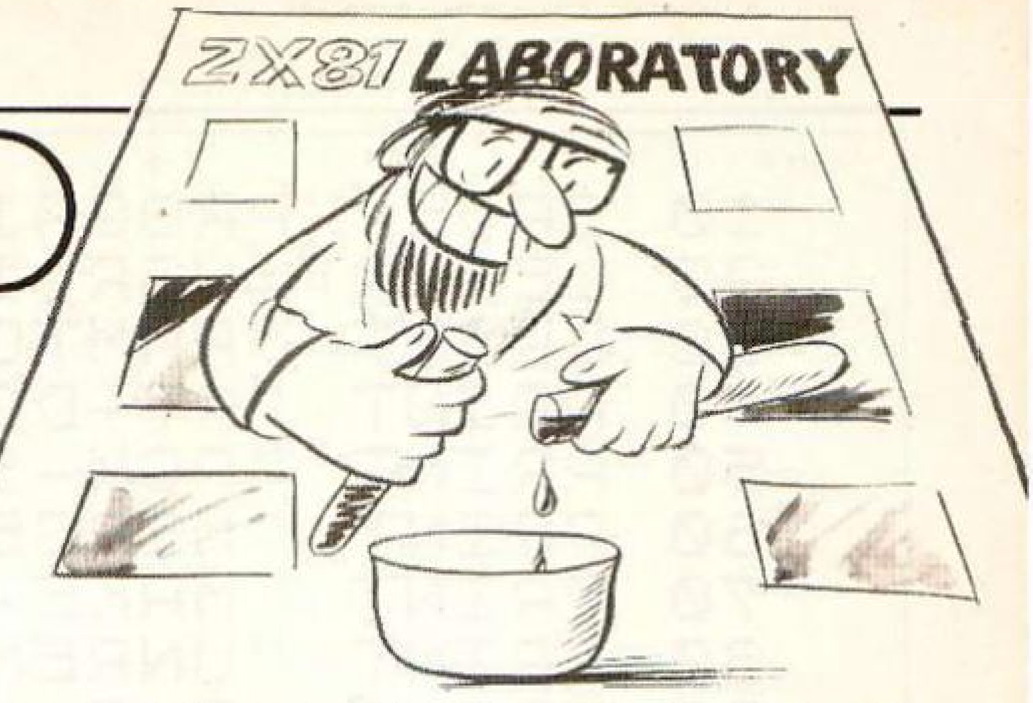
I have a feeling that floppy diskette manufacturers have over estimated demand for media products, and this year could see a real battle of the giants, with only the fittest to survive. For the consumer prices should fall substantially, perhaps by a quarter, but there must be some casualties at the factory end. New media coating plants are being built all over the world, with the strength of the dollar being a major influence.

Most of the big names in media are American, but for the foreign distributors of their products, the strong dollar has pushed up prices in local currency.

If American companies want to invest overseas, now is the cheapest time for them to do so, as a dollar buys a lot more factory in Ireland, Japan or Brazil than it did a year ago, and probably more than it is likely to buy in a year's time.

The recent strength of the dollar must be a welcome sight to many British computer manufacturers. Much of the buying of foreign micros is conducted in dollars, so these machines will become comparatively more expensive, while British machines exported to America have become correspondingly cheapear.

A promising start to the year for the British computer industry, with prospects of healthy competition for imported machines, especially those of American origin. ■



PROGAID

Albert Olivera takes you through a simple and short program designed to add a nine-function toolkit to your ZX-81.

PROGAID IS A toolkit program which provides the ZX-81 with nine functions not available in its ROM. The routines, which occupy 399 bytes, are written entirely in machine code and are implemented with USR calls.

The program automatically resets RAMtop and loads itself above it. It is relocatable and can be used with any size of RAM from 1K to 16K. If used with a RAM larger than 16K it will be necessary to set RAMtop to maximum before loading Progaid.

Once the program is loaded it autoruns and displays the addresses of the different routines. These addresses are the argument of the USR calls and vary with different sizes of RAM. On a 16K machine RAMtop is reset to 32369, and the addresses referred to in the rest of this article will assume the use of such a machine.

Utilities available

The following are the utilities available:

RT-DOWN (address 32369): This function allows the programmer to reserve a specified number of bytes above RAMtop, which is lowered and brought into operation without the execution of a New command. This means that any Basic program currently in the machine remains unaffected by the operation. The amount of memory it is wished to researve is specified by typing

RAND xxx

where "xxx" is the number of bytes being reserved — these must be more than 0 — for example RAND 100. The routine is then called by

PRINT USR 32369

which apart from resetting RAMtop, prints the new RAMtop figure — 32269 in our example.

PGM-SVR (address 32418): PGM-SVR — program saver — allows you to store a copy of the current Basic program behind RAMtop. Another Basic program can then be loaded and run, and Newed without the old program being lost. The old program has to be recalled using the Merge function — see below.

To implement PGM-SVR type

PRINT USR 32418

RAMtop will then be reset, the program will be copied behind it, and the new RAMtop figure will be printed.

MERGE (address 32453): This function is complementary to PGM-SVR and provides the facility to load a new program from tape without losing the one currently loaded. To use, first store the current program behind RAMtop with PGM-SVR. The second program is then loaded, thus overwriting the first one in Basic area.

By typing

PRINT USR 32453

the first program is transferred from behind RAMtop to the start of Basic area in front of the second program.

Line numbers are not tested in any way, so if care has not been taken beforehand line numbers — though not the lines themselves — will be duplicated in the first and second programs.

Such duplicated line numbers cannot be edited in the usual way, but they can be regularized with the Renumber facility — see later.

MAKE-REM (address 32518): This facility allows users to create a Line 1 Rem of any length. The length is specified by keying

RAND xxx

where xxx, which must be greater than 0, is the number of characters to be inserted in the Rem statement — and then

PRINT USR 32518

UNREM (address 32571): PRINT USR 32571 will strip all Rem statements — except in Line 1 Rem — from a program. Line 1 is excluded because it is often used to store machine-code subroutines.

RUB-LINE (address 32617): Blocks of Basic lines can be deleted using this function. The parameters of the block being deleted are set by typing

LIST xxx

(continued on page 152)

Figure 1.

```
16514: 018F01CD9F40C503 = 773     16722: 23722336EA2378B1 = 804
16522: 030303ED43DB4021 = 629     16730: 2805361C0B18F636 = 462
16530: 9B40018F01EDB0C1 = 970     16738: 7618C5CDE7022102 = 612
16538: C9ED4B32400CDC50E = 1043   16746: 00CDD809EB2A0C40 = 783
16546: 2A02400AFED422202 = 622    16754: AFED5228ECFFE523 = 1289
16554: 402100000039545DED = 568   16762: 2323237EFEEAE120 = 976
16562: 42F92278402A0440 = 646     16770: 0BCDF209E5EBCD5D = 1229
16570: ED52EB424BED5B7B = 1146    16778: 0AD118E1CDF20918 = 948
16578: 40EDB0ED53044042 = 931     16786: DCCDE7022A0A40CD = 979
16586: 4BC92A0C40117D40 = 500     16794: D809E52A3240CDD8 = 1031
16594: E5CD170AC50303C5 = 867     16802: 09CDF209EBD1CD5D = 1207
16602: CD757EC1626B09EB = 1090    16810: 0A18B6010A00C521 = 457
16610: 712370C1E12B1BED = 985     16818: 0200CDD809EB2100 = 700
16618: B81B424BC92A0440 = 663     16826: 00E52A0C40AFED52 = 841
16626: E54E2346C523E50B = 884     16834: E1C1230E09C5EB72 = 1027
16634: 0BC5217D40E52BCD = 907     16842: 23732BD5CDF209E1 = 1087
16642: 9E09D1C1E1EDB0C1 = 1400    16850: 18E7210A00CDD809 = 728
16650: D12204402A024009 = 428     16858: EB2A0C40AFED5244 = 915
16658: 220240506939F9B7 = 790     16866: 4DC8EB23234E2346 = 765
16666: ED42EBED52444D19 = 1027    16874: 237EC8C7FEED230B = 1100
16674: ED5B04402B1BEDB8 = 887     16882: 280678B128E218F1 = 874
16682: CD0702C3AE06CDE7 = 1025    16890: 7EC8FFE6BF7718E9 = 1381
16690: 022A3240E5110600 = 410     16898: B72A1C40ED721100 = 685
16698: 19444D217D40E52B = 664     16906: 00EBED52444DC92A = 942
16706: CD9E09E136002336 = 740     16914: 0C40117D40B7ED52 = 784
16714: 0123D14248131373 = 539     16922: ED4B14400B09ED5B = 744
                                  16930: 1040B7ED52444DC9 = 928
```

Figure 2.

```
10 SAVE "PROGAID"
20 LET RT=USR 16514
30 PRINT "RAMTOP    =";RT
40 PRINT "RT-DOWN   =";RT
50 PRINT "PGM-SVR   =";RT+49
60 PRINT "MERGE     =";RT+84
70 PRINT "MAKE-REM=";RT+149
80 PRINT "UNREM     =";RT+202
90 PRINT "RUB-LINE=";RT+248
100 PRINT "RENUMBER=";RT+274
110 PRINT "MEM-LEFT=";RT+359
120 PRINT "MEM-USED=";RT+374
130 CLEAR
140 POKE 16394,0
150 RAND 160
160 PRINT USR (PEEK 16388+PEEK
16389*256+248)
```

(continued from page 151)

where xxx is the "from" line number — for example

LIST 100

then

RAND xxx

where xxx is the "to" line number — for example

RAND 430

and finally

PRINT USR 32617

The examples given will result in lines 110 to 430 — inclusive — disappearing from the program.

RENUMBER (address 32643): This function renumbers a Basic program in steps of 10. It ignores Line 1 if it exists and converts the rest of the lines into 10, 20, 30, etc. Goto and Gosub destinations are not renumbered, but the routine flags these statemetns by converting the character immediately following Goto and Gosub into an inverse or graphic character. The routine is called by

PRINT USR 32643

or by

LIST USR 32643

which will give an automatic listing.

MEM-USED (address 32743): PRINT USR 32743 will display in bytes the amount of RAM occupied by the program currently in Basic area, including variables if these have been implemented.

The full machine code is shown in figure 1. The code is initially held in a Line 1 Rem statement, so the first task is to create a Rem line containing 427 characters.

To load the code in figure 1 use the hex loader provided with Pac 81 on page 89.

Figure 3.

```
RAMTOP    =32369
RT-DOWN   =32369
PGM-SVR   =32418
MERGE     =32453
MAKE-REM=32518
UNREM     =32571
RUB-LINE=32617
RENUMBER=32643
MEM-LEFT=32728
MEM-USED=32743
```

Immediately the code has been loaded save everything on tape; this will save having to enter the code all over again if an error has been made the first time. The loader program can then be erased one line at a time — or by using the Rub-Line function already in the Line 1 Rem,.ie. type

LIST 10, RAND 150-

and then

PRINT USR 16787

Hopefully, everything except Line 1 will disappear. If not, check the code between addresses 16787 and 16812, as there must have been an error made when loading the code.

The next step is to enter the Basic auto-loader program as in figure 2, but for te time being, for testing purposes, leave out lines 10 and 160. Again save the whole on tape before proceeding further.

Now run the program and you should get a display as in figure 3, assuming you are using a 16K machine. This display is the program's way of informing the user of the addresses that have to be used to call the different facilities.

You must now test each routine, following the instructions given earlier. If something does not work properly check that the code stored in Line 1 is correct, using the Read Facility in the hex loader. This program displays the contents of successive memory locations so long as any key is kept depressed.

No incorrect entry test

Once everything is in order insert lines 10 and 160 of the auto-loader program in Figure 2. Then save the program onto the definitive tape, using run so that it will auto-run when next loaded.

It is relevant to mention here that the auto-loader program has been written so that after resetting RAMtop and transferring the utilities behind it, both the Basic and variable areas will be cleared, leaving behind only the addresses message on display.

It should be noted that Progaid does not test for incorrect entries; thus if, for example, you use the Merge function without having first PGM-SVR'ed a program the machine will hang-up. Nevertheless, the routines *do* test where necessary that there is enough memory for any particular operation, returning an Error 4 message if there is not. ■

ASTEROID LANDER

ASTEROID LANDER is based on the arcade game in which the player must negotiate belts of moving asteroids in order to land his ship on the planet's surface.

In this version there are 10 screens of asteroids which increase in difficulty. The landing pad is placed in a different position every time. There are four skill levels which dictate the number of lives you get. Each ship comes with 50 gallons of fuel which is used up by using the thrust rockets.

Your ship is constantly moving down unless you fire your thrust rockets. Your ship's downward velocity remain constant.

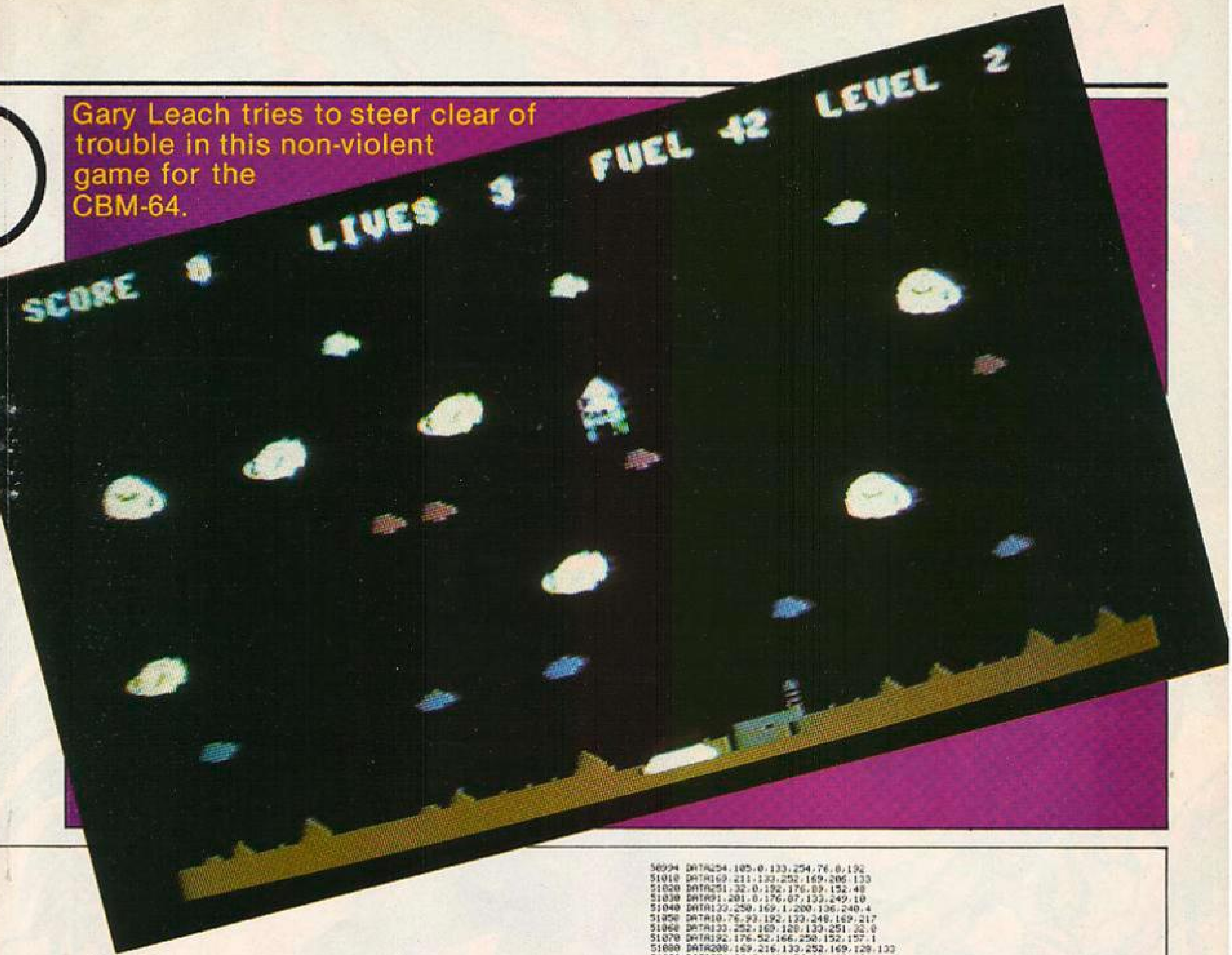
The keys are: up — O; up and left — I; up and right — P; down and left — z; down and right — X.

Many thanks to Commodore Computing International for the machine code routines to define characters and simulate print at.

To pause a game press space bar and then any key to continue.

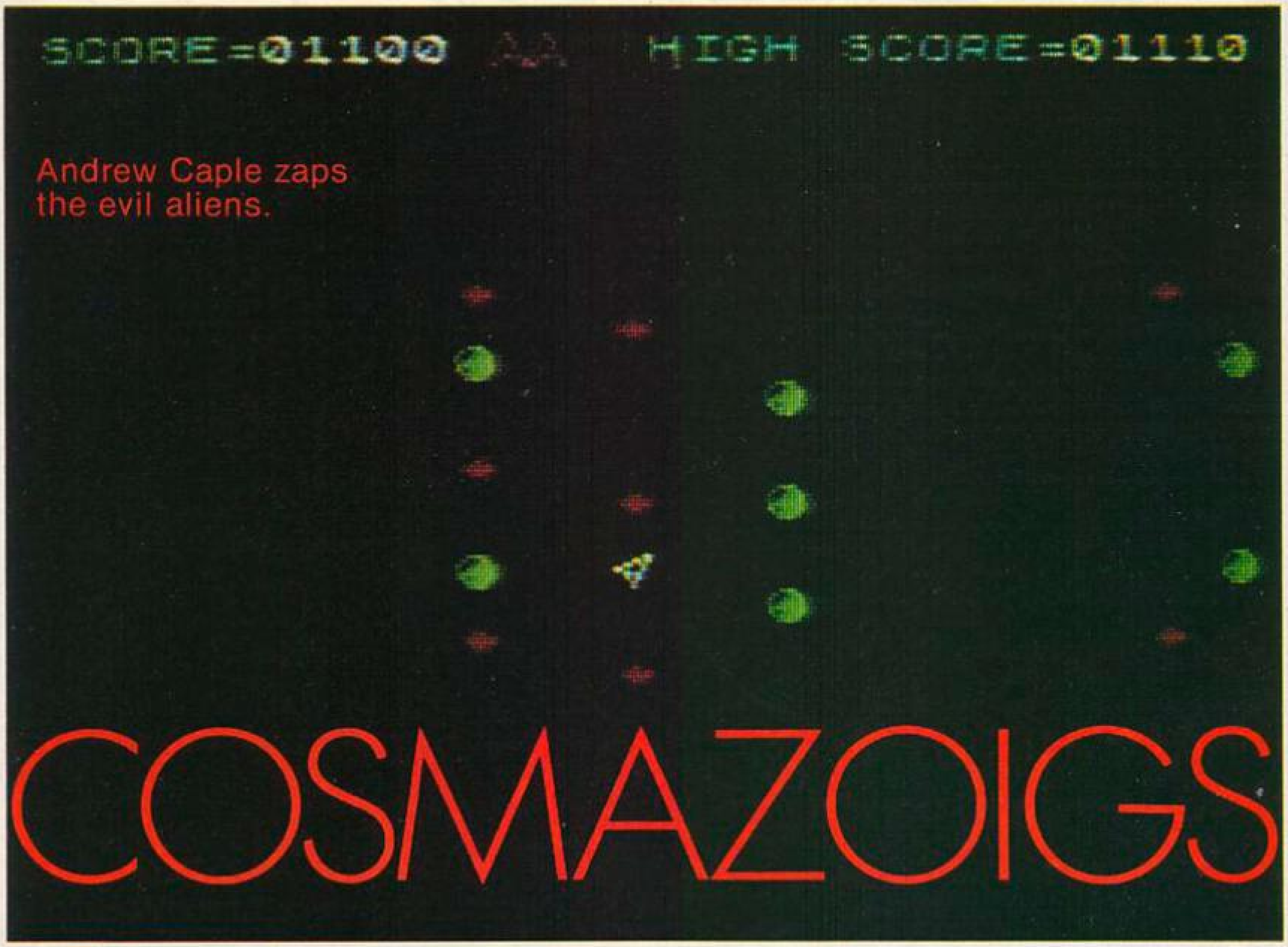
```
0 REM  FOR"■" READ INVERSE POUND SIGN
1 RESTORE:SH=0
2 CLR PRINT"■■■■■■■PLEASE WAIT!":SS=0 POKE53269,0 POKE53280,0 POKE53281,0
10 GOSUB50000:REM MACHINE CODE
20 GOSUB10000:REM  GRAPHICS
30 GOSUB20010:REM INSTRUCTIONS
40 GOSUB1000:REM MAIN GAME
50 END
110 REM LEVEL 1 STRINGS
111 A$(1)="                                        "
113 A$(2)=" V         V          V              V "
114 A$(3)="    L\           L/        \         L/"
115 A$(4)="        /┌┐      /┌┐          | /x     "
116 A$(5)="        ●_●      ●_●          O# |     "
117 A$(6)="    /┌┐      | /x             | /x     "
118 A$(7)="    ●_●      O# |             O# |     "
119 RETURN
120 REM LEVEL 2 STRINGS
121 A$(1)="          V        L\                V "
123 A$(2)=" V         V          V              V "
124 A$(3)="    L\       V      L/       \       L/"
125 A$(4)="        /┌┐     /┌┐   | /x   | /x     "
126 A$(5)="        ●_●     ●_●   O# |   O# |     "
127 A$(6)="    /┌┐      | /x             | /x     "
128 A$(7)="    ●_●      O# |             O# |     "
129 RETURN
130 REM LEVEL 3 STRINGS
131 A$(1)="          V        L\                V "
133 A$(2)=" V         V    L\    V              V "
134 A$(3)="    L\       V      L/       \       L/"
135 A$(4)="L\      /┌┐     /┌┐   | /x   | /x     "
136 A$(5)="        ●_●     ●_●   O# |   O# |     "
137 A$(6)="    /┌┐      | /x /┌┐   V      | /x   "
138 A$(7)="    ●_●      O# | ●_●          O# |   "
139 RETURN
140 REM LEVEL 4 STRINGS
141 A$(1)=" V        V          L\               V "
143 A$(2)=" V         V    L\    V              V "
144 A$(3)="    L\       V      L/       \       L/"
145 A$(4)="/┌┐      /┌┐   | /x   | /x      | /x   "
146 A$(5)="●_●      ●_●   O# |   O# |      O# |   "
147 A$(6)="    /┌┐ V     | /x /┌┐   V   | /x     "
148 A$(7)="    ●_●       O# | ●_●       O# |     "
149 RETURN
150 REM LEVEL 5 STRINGS
151 A$(1)=" V        V          L\               V "
153 A$(2)=" V         V    L\    V              V "
154 A$(3)="    L\       V      L/       \       L/"
155 A$(4)="/┌┐ V    /┌┐   | /x   | /x      | /x   "
156 A$(5)="●_●      ●_●   O# |   O# |      O# |   "
157 A$(6)="   V     | /x /┌┐    V    | /x     | /x"
158 A$(7)="         O# | ●_●         O# |     O# |"
159 RETURN
160 REM LEVEL 6 STRINGS
161 A$(1)=" V        V          L\        L\     V "
163 A$(2)=" V         V    L\    V     V        V "
164 A$(3)="    L\       V      L/       \       L/"
165 A$(4)="/┌┐ V    /┌┐   | /x   | /x      | /x   "
166 A$(5)="●_●      ●_●   O# |   O# |      O# |   "
167 A$(6)="      /┌┐ | /x /┌┐   V   | /x    | /x  "
168 A$(7)="      O# | O# | ●_● V     O# |    O# | "
169 RETURN
170 REM LEVEL 7 STRINGS
171 A$(1)=" V        V          L\        L\     V "
173 A$(2)="       V      V    L\    V     V      V "
174 A$(3)="L\   L\     V      L/     \     V L/    "
175 A$(4)="/┌┐ V    /┌┐   | /x   | /x      | /x   "
176 A$(5)="●_●      ●_●   O# |   O# |      O# |   "
177 A$(6)="      /┌┐ | /x /┌┐   V   | /x    | /x  "
178 A$(7)="      O# | O# | ●_● V    O# |  V  O# | "
179 RETURN
180 REM LEVEL 8 STRINGS
181 A$(1)=" V        V          L\    L\   L\    V "
182 A$(2)="       V      V    L\    V     V      V "
183 A$(2)="       V      V    L\    V     V      V "
184 A$(3)="L\   L\     V L/    L/    \    V  V     "
185 A$(4)="/┌┐ V    /┌┐ V         | /x    | /x    "
186 A$(5)="●_●      ●_●       L\  O# |    O# |    "
187 A$(6)="/┌┬┬┐    | /x /┌┐   V     | /x    | /x "
188 A$(7)="●___●    O# | ●_● V       O# |  V O# | "
189 RETURN
190 REM LEVEL 9 STRINGS
191 A$(1)=" V   V   V    L\     L\    L\   / L\  V "
193 A$(2)="        V    V      L\     V     V     V "
194 A$(3)="L\   L\     V L/    L/    \    V  L/    "
195 A$(4)="/┌┐V     | //x       | /x L/   | /x    "
196 A$(5)="●_●   \  O##  |   L\  O# |    O# |     "
197 A$(6)="/┌┬┬┐    | /x /┌┐   V    | /x    | /x  "
198 A$(7)="●___●    O# | ●_● V      O# |  V  O# | "
199 RETURN
200 REM LEVEL 10 STRINGS
201 A$(1)=" V   V   V    L\     L\    L\   V L\  V "
202 A$(2)="        V  L/  V     L\  \   V    V L/ V "
204 A$(3)="L\   L\     V L/     L/  \   \   V L/   "
205 A$(4)="/┌┐V     | //x   V L/| /x L/    | /x   "
206 A$(5)="●_●   \  O## |   L\  O# |     O# | L\  "
207 A$(6)="/┌┬┬┐    | /x /┌┐ /┌┐V   | /x    | /x  "
208 A$(7)="●___●    O# | ●_● ●_● L/ O# |  V  O# | "
209 RETURN
300 REM
310 GOSUB60100
320 GO=1 SX=160 SV=10 SC=SC+(LE*FU) SYS AT,0,8,"■";SC;" ":LE=LE+1:FU=50
330 GOTO1050
500 REM   CRASH ROUTINE
505 IF(PEEK(V+30)AND2)=2THEN300
510 GOSUB60000 LI$=STR$(LI-1)+" "
515 LI=LI-1 IFLI=0THENSYS AT,0,18,"■";LI$ GOTO25000
520 SX=160 SV=10 SYS AT,0,18,"■";LI$ XO=184 YO=60 SHO=0 SYS PO
530 FORN=0TO1000 IFPEEK(V+31)<>0THENNEXT
535 FU=50
540 RETURN
1000 REM  SET UP MAIN LOOP
1010 FORN=0TO24 POKESI+N,0 NEXT
1020 POKESP,16 POKESP+1,18 POKESP+2,19 POKESP+3,24
1030 FORN=0TO15 POKEV+N,0 NEXT POKEV+16,0 PRINT"■";
1031 SYSAT,10,3,"■1-EXPERT";SPC(40);
1032 PRINT"■2=REGULAR";SPC(40);
1033 PRINT"■3=AVERAGE";SPC(40);
1034 PRINT"■4=NOVICE";SPC(40);
1035 SYS AT,15,6," OUR CHOICE"::INPUTAC IFAC<1ORAC>4THEN1031
1036 LI=AC*2
1040 SC=0:FU=50 SX=162 SV=10 GO=0
1050 POKEV+39,1 POKEV+40,1 POKEV+41,11 POKEV+42,7
1070 PX=INT(RND(1)*272)+24 PY=216 XO=PX YO=PY SHO=1 SYS PO SHO=2 XO=XO+30 SYS P
O
1080 PX=(PX-24)/8 PY=22 PRINT"■",CHR$(142): IFGO=1THENDU=LE GOTO1110
1090 SYS AT,10,3,"WHICH LEVEL (1-10)": INPUTLE DU=LE
1100 IFDU>10ORDU<1THEN1090
1110 ON DU GOSUB110,120,130,140,150,160,170,180,190,200
1140 REM STATIC DISPLAY
1145 POKEV+30,0 POKEV+31,0
1150 PRINT"■": POKE53280,0 POKE53281,0 SYS AT,0,0,"■SCORE ";SC
1160 SYS AT,0,12,"■LIVES ";LI
1170 SYS AT,0,23,"■FUEL "
1180 SYS AT,0,32,"■LEVEL ";LE
1190 SYS AT,21,0,"■      -|            -|                  -|  -|  "
1200 SYS AT,22,0,"■■|----\,###|------\,-----#|-----------\,"\,"|
1210 PRINT"■■                                         ■": POKE33727,160 POKE56255
,9
1220 POKE53269,255 SYS AT,PY-1,PX,"    " XO=SX+24 YO=SV-50 SHO=0 SYS PO
1230 SYS AT,PY,PX,"    "
1240 FORN=0TO100 IF(PEEK(V+30)AND1)=1THENNEXT
1250 POKESI+5,255 POKESI+6,255 POKESI+4,129 POKESI,100
2000 REM  MAIN LOOP
2010 FORN=1TO3 A$(N)=MID$(A$(N),2,39)+MID$(A$(N),1,1) NEXT
2020 FORN=4TO7 A$(N)=RIGHT$(A$(N),1)+MID$(A$(N),1,39) NEXT
2030 SYS AT,4,0,"■";A$(1)
2040 SYS AT,7,0,"■";A$(4);A$(5)
2050 SYS AT,11,0,"■";A$(2)
2060 SYS AT,14,0,"■";A$(6);A$(7)
2070 SYS AT,18,0,"■";A$(3)
2075 IF(PEEK(V+31)AND1)=1THENGOSUB500
2080 J=PEEK(197) IFJ=64THEN2100
2090 SX=SX-4*(J=41ORJ=23)+4*(J=33ORJ=12)
2100 SY=SY+4 IF(J=41ORJ=33ORJ=38)ANDFU>=1THENSY=SY-6 FU=FU-1 POKESP,17 POKESI+2
4,15
2110 IFSX<0THENSX=0
2120 IFSX>304THENSX=304
2130 IFSY<10THENSY=10
2140 IFSY>200THENSY=200
2150 XO=SX+24 YO=SY+50 SHO=0 SYS PO
2160 HS=PEEK(V+30) IF(HSAND2)=2THENGOSUB300
2200 F$=STR$(FU)+" " SYS AT,0,27,"■";F$
2210 GETA$ IFA$=" "THENPOKE198,0 WAIT198,1,0
2220 POKESP,16 POKESI+24,0
9999 GOTO2010
10000 REM
10010 SYS CHARSET RESTORE
10020 FORN=1TO25
10030 READA,B,C,D,E,F,G,H
10040 SYS GRAPHIC,N+64,A,B,C,D,E,F,G,H
10050 NEXTN
10060 REM CHARACTER DATA
10070 DATA0,0,0,0,0,0,255,255
10080 DATA0,0,0,0,63,127,255,255
10090 DATA1,3,7,15,15,159,255,255
10100 DATA0,128,128,192,224,240,255,255
10110 DATA0,0,0,0,0,20,255,255
10120 DATA0,0,0,0,0,0,1,3
10130 DATA0,0,0,0,0,0,0,128
10140 DATA7,7,15,15,31,63,255,255
10150 DATA192,224,240,248,252,252,255,255
10160 DATA0,15,31,31,63,63,7,0
10170 DATA0,192,224,248,252,252,192,0
10180 DATA0,1,15,31,127,63,31,0
10190 DATA0,224,252,254,254,240,240,0
10200 DATA0,0,0,3,15,31,63,61
10210 DATA0,0,0,240,254,255,255,255
10220 DATA0,0,0,0,0,0,126,192
10230 DATA126,127,127,127,127,63,15,0
10240 DATA247,15,255,255,255,255,255,255
10250 DATA224,240,176,104,120,120,240,0
10260 DATA0,0,0,0,0,1,3,15
10270 DATA0,0,0,0,127,255,255,255
10280 DATA0,0,0,0,128,240,240,240
10290 DATA55,111,111,55,31,3,0,0
10300 DATA251,247,239,223,255,255,0,0
10310 DATA248,240,240,240,128,0,0,0
10320 REM
10330 REM
10340 REM
10350 REM   SPRITE  ----- SHIP
10360 B1=BL B2=B1+64
10370 FORN=B1TOB2+62 POKEN,0 NEXT
10380 FORN=0TO26STEP3
10390 READA,B POKEB1+N,A POKEB1+N+1,B POKEB2+N,A POKEB2+N+1,B
10400 NEXT
10410 DATA7,192,15,224,31,240,63,248,97,12,109,108,37,12
10420 DATA63,248,13,96,24,48,48,24,112,28,136,34
10430 FORN=27TO37STEP3 READA,B POKEB2+N,A POKEB2+N+1,B
10440 NEXT
10450 DATA27,176,51,152,113,28,137,34
10460 REM
10470 REM
10480 REM SPRITE------LANDING PAD
10490 B3=B2+64 FORN=0TO62 POKEB3+N,0 NEXT FORN=51TO62 READA POKEB3+N,A NEXT
10500 DATA31,255,240,63,255,252,255,255,255,255,255,255
10510 REM
10520 REM
10530 REM  SPRITE-----BASE
10540 B4=B3+64 FORN=0TO13 POKEB4+N,0 NEXT FORN=14TO62 READA POKEB4+N,A NEXT
10550 DATA30,0,0,63,0,0,63,0,32,51,0,64,63,0,128,51,1,64,63
10560 DATA2,64,51,0,64,63
10570 DATA255,255,255
10580 DATA255,255,255
10590 DATA255,255,255
10610 DATA240,15,255
10620 DATA255,254,31
10630 DATA255,254,31
10640 DATA255,254,31
10650 DATA255,254,31
```

Gary Leach tries to steer clear of trouble in this non-violent game for the CBM-64.




```
20000 RETURN
20010 PRINTCHR$(14):SYS AT,10,3,"INSTRUCTIONS ( ES OR /O)"; INPUT AC$
20020 IFAC$=""THEN20010
20030 AC$=MID$(AC$,1,1) IFAC$="N"THENRETURN
20040 IFAC$<>"Y"THEN20010
20050 PRINT"J"; SYS AT,1,5,"IELLO AND WELCOME TO"
20060 SYS AT,2,12,"
20070 SYS AT,3,13,"
20080 PRINT"HE OBJECT OF THIS GAME IS TO PILOT YOURSHIP TO THE LANDING PAD ";
20090 PRINT" ON THE PLANETS SURFACE. OU MUST NEGOTIATE AN ASTEROID  BELT AND N"
;
20100 PRINT"OT RUN OUT OF FUEL. OU HAVE   BETWEEN 3 AND 12 SHIPS DEPENDING ON T
HE ";
20110 PRINT"SKILL LEVEL YOU CHOOSE AND EACH SHIP    CONTAINS 50 GALLONS OF FUEL
";
20120 PRINT"TO POWER ITSTHRUST ROCKETS.HERE ARE TEN SCREENS    WHICH INCREASE
";
20130 PRINT"IN DIFFICULTY. OU MAY    CHOOSE TO START ON ANY 1 OF THESE LEVELS."
;
20140 PRINT"EWARE OF GRABBING ASTEROIDS. WHICH    THROW YOU UP AND DOWN IN A "
;
20150 PRINT"FORCE FIELD  LEADING TO THE LOSS OF MANY OF YOUR     LIVES."
20160 PRINT"
20170 SYS AT,23,4,"RESS ANY KEY"
20175 FORN=0TO50:NEXT
20180 SYS AT,23,4,"PRESS ANY KEY"
20185 FORN=0TO50:NEXT
20190 GETA$:IFA$=""THEN20170
20500 RETURN
25000 POKE53269,0:REM END OF GAME
25010 PRINT"J"; IFSC>SHTHENSH=SC:SYSAT,10,5,""; INPUT"YOUR NAME PLEASE";NA$
25020 PRINT"J"; SYSAT,14,6,"HI SCORE = ";SH
25030 SYS AT,16,8,"BY ";NA$
25040 SYS AT,19,3,"WANNANUVERGO"; INPUTAC$ IFAC$=""THEN25040
25050 AC$=MID$(AC$,1,1):IFAC$="N"THENEND
25060 IFAC$<>"Y"THEN25040
25070 PRINTCHR$(14); GOTO40
30000 REM
49999 REM
50000 REM MACHINE CODE
50010 REM
50230 REM DATA FOR AT ROUTINE
50231 FORN=1TO25:READA,B,C,D,E,F,G,H:NEXT:FORN=1TO46:READA:NEXT
50232 FORN=14TO62:READA:NEXT
50240 I=49351
50250 READA:IFA=-1THEN50370
50260 POKEI,A:I=I+1
50270 GOTO50250
50280 DATA32,241,183,134,87,32,241
50290 DATA183,134,88,224,40,176,6
50300 DATA165,87,201,26,144,3,76
50310 DATA72,178,32,182,229,165,87
50320 DATA240,9,169,17,32,22,231
50330 DATA198,87,208,247,165,88,240
50340 DATA8,169,29,32,22,231,198
50350 DATA88,208,247,32,253,174,76
50360 DATA160,170,-1
50370 REM
50940 REM
50950 REM   SPRITE POS
50960 I=49152
50970 READA:IFA=-1THEN51180
50980 POKEI,A:I=I+1
50990 GOTO50970
50991 DATA165,46,133,254,165,45,133,253,160,0,165,254,197,48,208,8,165,253,197
50992 DATA47,208,2,56,96,177,253,197,252,208,17,200,177,253,197,251,208,11,200
50993 DATA177,253,170,200,177,253,168,24,96,200,152,24,105,6,101,253,133,253,16
5
50994 DATA254,105,0,133,254,76,0,192
51010 DATA169,211,133,252,169,206,133
51020 DATA251,32,0,192,176,89,152,48
51030 DATA91,201,0,176,87,133,249,10
51040 DATA133,250,169,1,200,136,240,4
51050 DATA10,76,93,192,133,248,169,217
51060 DATA133,252,169,128,133,251,32,0
51070 DATA192,176,52,166,250,152,157,1
51080 DATA208,169,216,133,252,169,128,133
51090 DATA251,32,0,192,176,33,138,72
51100 DATA166,250,152,157,0,208,104,201
51110 DATA0,208,11,165,248,73,255,45
51120 DATA16,208,141,16,208,96,165,248
51130 DATA13,16,208,141,16,208,96,162
51140 DATA11,108,0,3,162,14,108,0
51150 DATA3,162,10,160,0,24,32,156
51160 DATA255,200,132,43,134,46,169,0
51170 DATA141,0,10,76,66,166,-1
51180 I=49500
51190 READA:IFA=-1THEN51380
51200 POKEI,A:I=I+1
51210 GOTO51190
51220 DATA169,0,133,87,169,208,133
51230 DATA88,169,0,133,89,169,176
51240 DATA133,90,173,14,220,41,254
51250 DATA141,14,220,165,1,41,251
51260 DATA133,1,160,0,177,87,145
51270 DATA89,24,165,87,105,1,133
51280 DATA87,133,89,144,241,230,88
51290 DATA230,90,165,88,201,224,208
51300 DATA231,165,1,9,4,133,1
51310 DATA173,14,220,9,1,141,14
51320 DATA220,173,2,221,9,3,141
51330 DATA2,221,173,0,221,41,252
51340 DATA9,1,141,0,221,169,128
51350 DATA141,136,2,133,56,133,52
51360 DATA169,12,141,24,208,32,68
51370 DATA229,96,-1
51380
51390 I=49700
51400 READA:IFA=-1THEN51600
51410 POKEI,A:I=I+1
51420 GOTO51400
51430 DATA32,253,174,32,235,183,132
51440 DATA91,133,92,160,3,165,20
51450 DATA133,88,165,21,133,89,134
51460 DATA90,24,6,88,38,89,136
51470 DATA208,248,169,176,24,101,89
51480 DATA133,89,201,191,144,3,76
51490 DATA72,178,169,0,133,87,165
51500 DATA90,164,87,145,88,162,0
51510 DATA164,91,165,92,32,241,183
51520 DATA134,90,230,87,165,87,201
51530 DATA7,208,231,165,90,164,87
51540 DATA145,88,96,-1
51600 AT=49351:PO=49217:CH=49500:OR=49700:SI=54272:V=53248:S=32768:CO=55296
51605 BL=33792:SP=33784
51610 RETURN
60000 REM****CRASH SOUND****
60001 FORN=0TO24:POKE54272+N,0:NEXT
60010 Z=54272
60020 POKEZ+24,15:POKEZ+5,9:POKEZ+6,240:POKEZ+4,32
60040 FORN=0TO100STEP10
60050 POKEZ+1,N:POKEZ+4,33:POKEZ+4,129:POKEZ+4,17
60060 FORB=0TO1:POKE53280,B:POKE53281,B:NEXTB:POKE53287,N:NEXTN:POKEZ+4,129
60070 FORC=0TO100:FORN=0TO1:POKE53280,N:NEXTN:POKE53287,C:NEXTC
60080 FORN=0TO24:POKEZ+N,0:NEXT:POKE53280,0:POKE53281,0:POKE53287,1
60090 POKEZ+5,255:POKEZ+6,255:POKEZ+24,0:POKEZ+4,129:POKEZ,100:POKE53249,60:RET
URN
60100 REM****SOUND 2 ROUTINE****
60110 Z=54272:POKESP,17
60120 POKEZ+24,15:POKEZ+5,9:POKEZ+6,240
60130 POKEZ+24,15
60140 POKEZ+5,9:POKES+6,240
60150 FORN=200TO0STEP-1
60160 POKEZ+1,N:POKEZ+4,129:Y2=N:SH2=0:SYS PO:POKE53287,N:NEXT
60170 FORN=0TO24:POKEZ+N,0:NEXT:POKE53280,0:POKE53281,0
60180 RETURN
```

THERE IS ONLY ONE KING
OF THE SOFTWARE JUNGLE!
Joe the lion
Joe the lion
Rules O.K.
Bimbo
Joe the lion
Loki
Joe the lion
CHALLENGER
Joe the lion
Bimbo £5·45
Any Spectrum
Loki £6·45
48 K Oric
Challenger £7·45
BBC B
Distributors please contact Laurence Holt Tel :- 061-366-7431. Available from good software outlets.



Andrew Caple zaps the evil aliens.

COSMAZOIGS

Program 1.

```
  10 REM     PROGRAM ONE
  15 REM
  20 BORDER 0: PAPER 0: INK 7
  30 BRIGHT 1: CLEAR 30440
  35 POKE 23676,127
  40 PRINT AT 11,4; FLASH 1;"""C
OSMAZOIGS"" IS LOADING!"
  60 PRINT AT 9,10; INVERSE 1; F
LASH 1;"PLEASE WAIT!"
  70 FOR F=12 TO 15: BEEP .05,F
  80 NEXT F
  90 INK 0: PRINT AT 15,0;
  92 LOAD ""CODE
  95 INK 7: PAPER 0: CLS
  96 PRINT AT 10,11;"COSMAZOIGS"
  97 GO SUB 2300
  98 DIM N$(11,22)
  99 FOR F=1 TO 11
 100 REM
 101 REM  SET UP SCORE TABLE
 102 REM
 105 LET N$(F)="00000 ___________
_______": NEXT F
 107 CLS
 110 PRINT AT 6,11;"THE POINTS"
 120 PRINT AT 8,8; INK 2;CHR$ 14
5; INK 7;"......10 POINTS"
 130 PRINT AT 10,8; INK 4;CHR$ 1
46; INK 7;".....100 POINTS"
 140 PRINT AT 12,8; INK 6;CHR$ 1
47; INK 7;"....1000 POINTS"
 145 PAUSE 100: CLS
 150 PRINT AT 4,12;"THE KEYS"
 160 PRINT AT 7,8;"6> ROTATE LEF
T"
 170 PRINT AT 9,8;"7> ROTATE RIG
HT"
 180 PRINT AT 11,8;"8> SUSPEND G
AME"
 190 PRINT AT 13,8;"9> THRUST"
 200 PRINT AT 15,8;"0> FIRE"
 210 PAUSE 100: CLS
 220 PRINT TAB 11;"THE SCORES"
 230 PRINT
 240 FOR F=1 TO 10
 245 PRINT 'TAB 5; INK 6-INT ((F
-1)/2);N$(F, TO 5); INK 7;N$(F,6
 TO )
 250 NEXT F
 260 PAUSE 100: CLS
 270 IF INKEY$="" THEN GO TO 107
 280 CLS : BEEP .2,10
 285 IF INKEY$<>"" THEN GO TO 28
5
 290 INPUT TAB 7; BRIGHT 1;"SPEE
D (0 TO 9) "; LINE A$
 300 IF LEN A$<>1 THEN GO TO 290
 305 IF A$(1)<"0" OR A$(1)>"9" T
HEN GO TO 290
 310 LET A=13-VAL A$
 320 POKE 32757,A
 330 PRINT AT 0,0; INK 5;"SCORE=
"; INK 7;"00000 "; INK 3;CHR$ 15
2;CHR$ 152;CHR$ 152; INK 5;" HIG
H SCORE="; INK 7;N$(1, TO 5)
 340 LET L=2
 350 LET X=USR 30448
 360 PRINT AT 0,12+L;" "
 370 LET X=USR 30470
 380 LET L=L-1
 390 IF L<>0 THEN GO TO 360
 400 BORDER 0
 410 LET X$=""
 420 FOR F=6 TO 10
 430 LET X$=X$+STR$ (PEEK (F+317
44)-144)
 440 NEXT F
 450 LET F=1
 460 IF F=11 THEN GO TO 670
 470 IF X$<N$(F, TO 5) THEN LET
F=F+1: GO TO 460
 480 FOR G=10 TO F STEP -1
 490 LET N$(G+1)=N$(G)
```

(Program 1 continued on page 159)

COSMAZOIGS WAS WRITTEN on a 16K model one Spectrum though it will run on a 48K model. The features of the game are:

- Up to 66 independently moving characters on the screen at any one time.
- Full ship control.
- Screen wrap.
- Action sounds.
- Ten personalised high scores.
- On screen scoring.
- Hold key.
- Tunes.

On loading the program should load a sequencial bytes file automatically, then attempt to play a well known theme tune. The program only plays this once so you need not worry. The last chorus may be omitted by deleting lines 2380 to 2390. The high score table is then initialised.

Once all the variables have been set the computer enters the main wait routine. This involves cycling through three different tables. First is the points, second is the control keys and finally the high scores.

To start the game hold a key down until the screen clears and you hear a blip, then release the key. The Speed prompt will then appear which will accept values from zero to nine.

The game should now commence, if not recheck the programs Save them, verify them and try again.

The idea was taken from the Asteroids machines though some liberties have been taken with the graphics.

(continued on page 159)

METAGALACTIC LLAMAS BATTLE AT THE EDGE OF TIME
A fast and original game for the unexpanded VIC. Challenging and colourful, with good sonics and a unique game action and design, this promises to be the most exciting new 3.5K VIC game since the introduction of GRIDRUNNER nearly a year ago. £5.50
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MATRIX
Jeff Minter has taken Gridrunner – the game that topped bestseller charts in USA and UK – and created an awesome sequel.
Graphically superb, it features multiple screens, new aliens and attack waves, mystery bonuses, renegade humanoids, deflexor fields, diagonal tracking, countdown/panic phase and much, much more... Packed into 20 mind-zapping zones and accompanied by incredible sonics.
8K expansion required.
Available for Commodore 64 £7.50 and VIC-20 £6.
HOVER BOVVER
A totally original arcade game for C64 featuring outstanding graphics and a sound track created by a professional Piano Wizard. Gordon Bennet has borrowed his neighbour's Air-Mo lawnmower. Mow your way through as many of the 16 lawns as you can before the pursuing neighbour retrieves his mower. Set your dog onto the neighbour to help you out of tight spots and don't annoy the gardener. Try not to plough through the neat flower beds or overheat your mower! £7.50
ATTACK of the MUTANT CAMELS
Planet earth needs you! Hostile aliens have used genetic engineering to mutate camels from normally harmless beasts into 90 foot high, neutronium shielded, laser-spitting death camels!! Can you fly your tiny, manoeuvrable fighter over the mountainous landscape to weaken and destroy the camels before they invade the humans stronghold! You must withstand withering laser fire and alien UFOs. Game action stretches over 10 screen lengths and features superb scrolling, scanner 1/2 player actions and unbelievable animation! Play this game and you'll never be able to visit a zoo again without getting an itchy trigger finger! Awesome m/c action!
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(Program 1 continued from page 157)

```
 500 NEXT G
 510 LET N$(F)=X$+"
    "
 520 FOR G=1 TO 21
 530 PRINT AT G,0;"
                                 "
 540 NEXT G
 545 FOR G=23232 TO 23295
 546 POKE G,0: NEXT G
 550 PRINT AT 7,5; INK 4;"YOU HA
VE ONE OF TODAYS";AT 9,1;"HIGHES
T SCORES PLEASE TYPE YOUR";AT 11
,14;"NAME";AT 14,5; INK 6-INT ((
F-1)/2);X$; INK 7;" ____________
____"
 560 LET G=11: POKE 23658,0
 570 LET A$=INKEY$
 580 IF A$="" THEN GO TO 570
 590 IF CODE A$=13 THEN GO TO 68
0
 600 IF A$<" " OR A$>"z" THEN GO
 TO 570
 610 PRINT AT 14,G;A$
 620 LET N$(F,G-4)=A$
 630 BEEP .01,20: LET G=G+1
 640 IF G=27 THEN LET G=11
 650 IF INKEY$<>"" THEN GO TO 65
0
 660 GO TO 570
 670 PRINT AT 11,11; FLASH 1;"GA
ME  OVER"
 680 FOR F=1 TO 100: NEXT F
 690 GO TO 107
 999 STOP
1000 REM TUNE DATA
1010 DATA 5,6,6,1.25,1,.75,8,6.5
,1,.5,6,T,8,T,10,T,99
1020 DATA 8,1,5,1.5,1,.5,6,T,8,T
,10,T,8,2.5,1,.5,6,T,8,T,10,T,8,
1,5,1.5,5,.5,6,T,5,T,1,T,1,2.5,9
9
1030 DATA 1,.5,6,T,8,T,10,T,99
1040 DATA 13,.5,13,T,10,T,8,T,99
1050 DATA 12,.75,8,.25,10,.75,6,
.25,8,.75,13,.25,12,T,10,T,8,T,1
2,1,6,1,5,.5,13,.5,12,T,10,T,8,T
,99
1060 DATA 12,.75,8,.25,10,.75,6,
.25,8,.75,5,.25,6,T,5,T,1,T,1,2.
5,13,.5,12,T,10,T,8,T,99
1070 DATA 12,1,10,.75,13,.25,8,.
75,5,.25,6,T,5,T,1,T,1,2.5,1,.5,
6,T,8,T,10,T,99
1080 DATA 12,.75,8,.24,10,.75,6,
.25,8,.75,5,.25,6,T,5,T,1,T,1,2.
5,1,.5,6,T,8,T,10,T,99
1090 DATA 8,1,5,1.5,1,.5,13,T,12
,T,10,T,8,2.5,1,.5,13,T,12,T,10,
T,8,1,5,1.5,5,.5,6,.5,8,.5,13,2.
5,1,.5,6,T,5,T,1,T,5,2.5,1,.5,6,
T,5,T,1,T,1,2.5,1,.5,6,T,5,T,1,T
,1,2.5,1,.5,6,T,5,T,1,T,1,3,-4,1
,1,3,-4,1,-11,4,99
2000 LET T=1/3
2005 READ N
2010 IF N=99 THEN RETURN
2020 READ M
2030 BEEP M/5,N
2040 GO TO 2005
2100 REM MAIN TUNE
2110 RESTORE 1020: GO SUB 2000
2120 GO SUB 2000
2130 RESTORE 1020: GO SUB 2000
2140 RESTORE 1040: GO SUB 2000
2150 GO SUB 2000
2160 GO SUB 2000
2170 RESTORE 1050: GO SUB 2000
2180 RETURN
2200 REM INTRO
2210 FOR Z=1 TO 12
2220 BEEP 1/8,-11
2230 NEXT Z
2240 BEEP .2,1
2250 BEEP .8,8
2260 RETURN
2300 REM PLAY TUNE
2310 GO SUB 2200: GO SUB 2200
2320 GO SUB 2200
2330 FOR Z=1 TO 16
2340 BEEP 1/8,-11
2350 NEXT Z
2360 RESTORE 1000: GO SUB 2000
2370 GO SUB 2100
2380 RESTORE 1070: GO SUB 2000
2390 GO SUB 2100
2400 RESTORE 1080: GO SUB 2000
2410 GO SUB 2000
2420 RETURN
```

(continued from page 157)

The object of the game is to furiously blast away anything and everything that dares cross your flightpath.

Once you have sent all the aliens to that big asteroid in the sky another yellow one appears and the game repeats. If it is any consolation all the aliens move in the same manner. There was at one stage a homing saucer but I think you have probably got enough on your plate.

The ship can be moved in several different ways. Pressing keys 6 and 7 rotates the craft in positive and negative directions respectively. Key 9 thrusts the ship in the direction that it is pointing and Phi fires the lazer. The magic panic button is key 8 which suspends the game until a different key is hit.

When you collide with any of the aliens you lose a life and the position of the craft is reset to somewhere in the centre of the screen.

Remember you have three lives like in most arcade games except for the ultimate in software. If you have a life left the game continues but if you have not the computer then checks all the scores in the high score table. If your score is greater than or equal to any in the table then your name is requested.

To input your name just type your name as if you were typing without capital shift lock. Unfortunately there is no repeat on any of the keys and delete will not function. When the print position reaches the end of the line it returns to the existing data. When you are satisfied with what you have typed press Enter.

The program now returns to cycling through the points, keys and scores tables.

Two programs are needed before the game can be played. First is program 1 which is the main control routine. Once entered check the listing then Save it by typing:

SAVE "COSMAZOIGS" LINE 1

which should give automatic running, then verify it. Now change tapes and enter program 2 which loads the machine code into its proper location in memory. The code is read from the data statements in lines 90 to 470.

A check digit is recorded at the end of the statement to give a rough verification of the code, but please note mistakes can still slip through this check undetected.

Another check that is imposed is an address test which decides whether the machine code is being Poked into memory about RAMtop. If you type this bit wrongly you could crash the loader so Save and Verify this program before running it. If the program finds any mistakes then check the line that is given in the error report. Then resave and reverify it.

Presuming all went to plan you can try running the machine code. To do this type:

LET L = USR 30448:BORDER 0

If that crashes then reload the program, correct it, Save it and Verify it. You must not take chances when Pokes and USR calls are involved.

Once you have a working version save the object code after your recording of program 1. To do this type:

SAVE "COSMACODE" 30446,2322

Of course Verify it. Now you have a recorded version of program 1 followed by a bytes file generated by program 2. When you load the game, program 1 should automatically Run and load the code.

Program 2.

```
   1 REM     PROGRAM TWO
   2 REM
   5 CLEAR 30440
  10 BORDER 0: INK 3: PAPER 0
  15 CLS : OVER 1
  20 PLOT 128,0
  25 DRAW 0,165,2771*PI
  30 PLOT 128,0
  35 DRAW 0,165,-2771*PI
  40 OVER 0: INK 7: BRIGHT 1
  45 PRINT AT 0,0;"""COSMAZOIGS"
" BY ANDREW CAPLE83"
  50 PRINT AT 11,10; FLASH 1;"PL
EASE WAIT!"
  55 GO TO 500
  80 REM
  81 REM   MACHINE CODE DATA
  82 REM
  90 DATA "7F582466E73838E766240
82A1C7F7F1C2A083C4E9FBFFFDF7E3C3
C66FFA5A5FF663C000000181800000000
000018180000000000001818000000
0000018180000001818242425AA5C30
30D32C234140808C0B04C23234CB0C00
8081434C2320D03C3AD5A42242418181
010282C434CB0C0030D32C4C4320D03C
0B04C432C2810100"
 110 DATA "7F00C5D5E577CB7F200E4
FC6405F167F1A4711587F791807E67F0
64711003DE56F26002929219D1EB7CD
```

(Program 2 continued on page 160)

(Program 2 continued from page 159)

```
6246770D650878787670608 1A7713241
0FAE1D1C1C93"
 130 DATA "7AD04210FE3E10A94FD3F
E7A8357C9F3C53A485C0F0F0F4FCB7B2
807CDD07A38FB1805CDD07A30FBC1FBC
90"
 150 DATA "7AA07CFE7F2009267C7DE
61FC6206FC9D511E083EB19EBD1D87DE
61FC6E06F267EC92"
 170 DATA "7A70FFE0FFE1000100210
020001FFFFFFFDFF5D5E60787C670E52
67A6F56235EE119CDA07AD1F1C98"
 190 DATA "7A5021207C3E80CD007FE
511107FEBED52110400CDB503E1237CF
E7F20E7C93"
 210 DATA "7A002AFE7F06017EFE04D
83E80CD007F01FEEFED403AFD7F4FCB6
020010DCB58200 10C79E6074FCB48CC8
07A7932FD7F22FE7F06017EFE04D8047
9C608C3007F2"
 230 DATA "7F40474244464747474 74
7474747474747475"
 250 DATA "7FF4000A0301000000000
001807D9"
 270 DATA "79D0DDE5E5D5C5267CC60
66F7E3CFE9A20083E90CD007F2B18F2C
D007F110800210002CDB503C1D1E1DDE
1C95"
 290 DATA "79B0E521FB7F5E2356131
37AFE1020021600EB22FB7F5E2356E1D
5C1C92"
 310 DATA "7950CD507A21007B36802
37CFE7C20F8CDB0797AE60F260087878
787873001246F01807C09CB7A20043E1
F856FEB21007B3E03772373 2372EBCD0
07F21907D22FE7FCDB0797BE60732037
BAF32FD7FC608C3007F7"
 330 DATA "7940DD6E01DD66027EF53
E80CD007FF1C94"
 350 DATA "78E0CD4079FE043804FE0
83817DD7E03CD807A3E03CD007FDD750
1DD7402110001DD19C9DDE5112000060
8783DDD7703E5CD807ADD7501DD74023
E02DD7700CD007FE1DD1910E43E01CDD
079DDE1110001DD19C90"
 370 DATA "7880CD4079FE043804FE0
83817DD7E03CD807A3E02CD007FDD750
1DD7402112000DD19C9DDE5110400060
8783DDD7703E5CD807ADD7501DD74023
E01DD7700CD007FE1DD1910E43E02CDD
079DDE1112000DD19C93"
 390 DATA "7850CD4079FE043804FE0
83813DD7E03CD807A3E01CD007FDD750
1DD74021809DD3600803E03CDD079110
400DD19C99"
 410 DATA "77E03AF77F3D201501FEE
FED780FD83AFD7F32FA7F2AFE7F22F87
F3E0A32F77F4F2AF87F7EFE043817FE0
830053E80CD007F3AFA7FCD807A22F87
F7EFE8028073E0132F77F18053AF77F3
DC83AFA7FE603C604CD007F798787878
7C680571E08C3DD7A9"
 430 DATA "77A00601DD21007BDD7E0
0FE8020071 10400DD19181904C53D200
5CD5078180E3D2005CD807818063D200
3CDE078C1DDE5E17CFE7C20D105C03E0
132F77FC350790"
 450 DATA "774021207C3E80CD007F2
37CFE7F20F5CDA077CDB0797AE6070F0
F0F267D6F7BE60FC608856F7EFE8020E
822FE7F3AFD7FE607C608CD007F11010
1CDDD7A0608783D87878732485C11018
0CDDD7A10F03E0132F77FC92"
 470 DATA "76F021067C3E90CD007F2
37DFE0820F5CD50793E0132F77F3AF67
F3D200CCDA077CD007A05CA40773E033
2F67FCDE0772AF47F7CB52B20FB3A085
CFE3828F918D74"
 500 LET A=10: LET B=11
 510 LET C=12: LET D=13
 520 LET E=14: LET F=15
 525 LET T=0
 530 FOR L=90 TO 470 STEP 20
 540 RESTORE L
 550 READ A$
 560 FOR X=1 TO LEN A$-1
 570 LET T=T+VAL A$(X): NEXT X
 580 LET T$=STR$ T
 585 LET T$=T$(LEN T$)
 590 IF T$<>A$(LEN A$) THEN GO T
O 900
 600 LET Y=4096*VAL A$(1)
 610 LET Y=Y+256*VAL A$(2)
 620 LET Y=Y+16*VAL A$(3)
 630 LET Y=Y+VAL A$(4)
 640 IF Y<30440 THEN GO TO 900
 650 LET A$=A$(5 TO )
 660 LET X=16*VAL A$(1)+VAL A$(2)
 670 POKE Y,X: LET Y=Y+1
 680 LET A$=A$(3 TO )
 690 IF A$<>T$ THEN GO TO 660
 700 NEXT L
 710 CLS
 720 PRINT AT 10,14;"SAVE";AT 11
,15;"IT"
 730 CIRCLE 128,87,30
 740 STOP
 900 CLS
 910 PRINT AT 10,7; FLASH 1;"ERR
OR AT LINE ";L
 920 FOR H=0 TO 2: BEEP .05,H
 930 BORDER H: NEXT H
 940 GO TO 920
```

■

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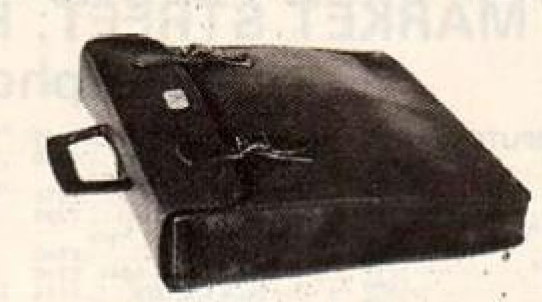

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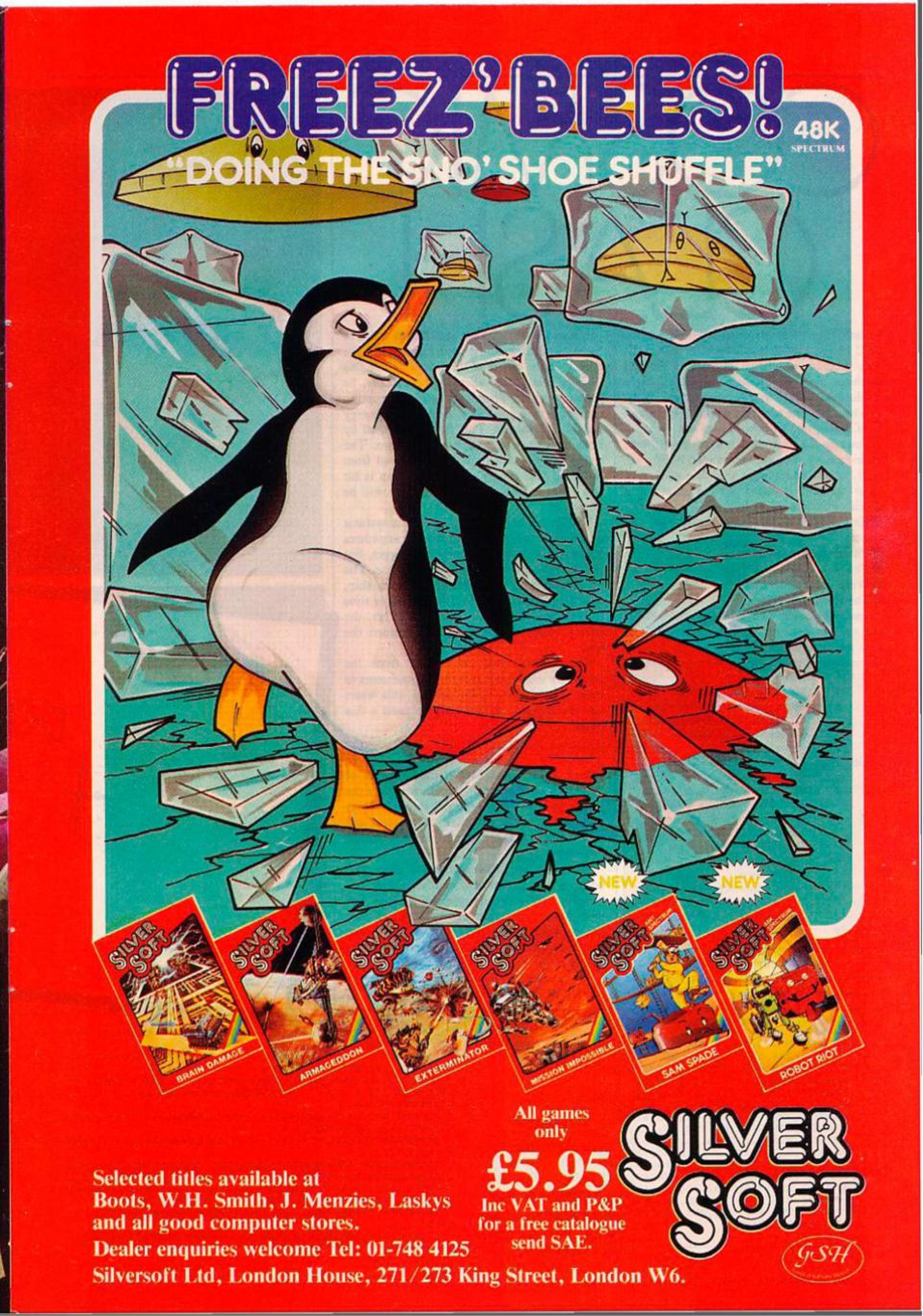
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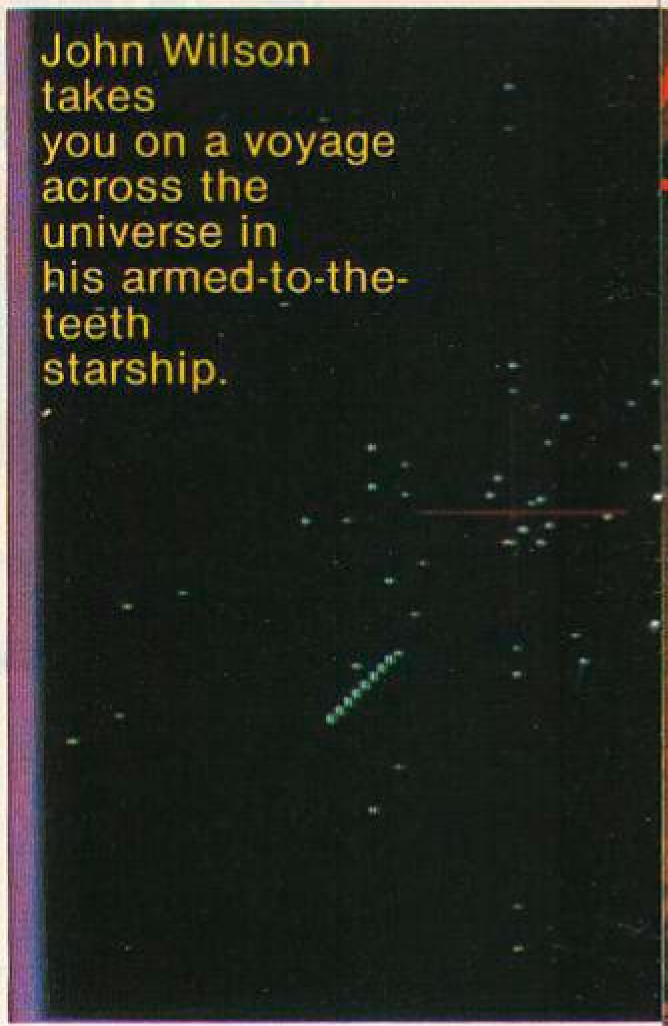
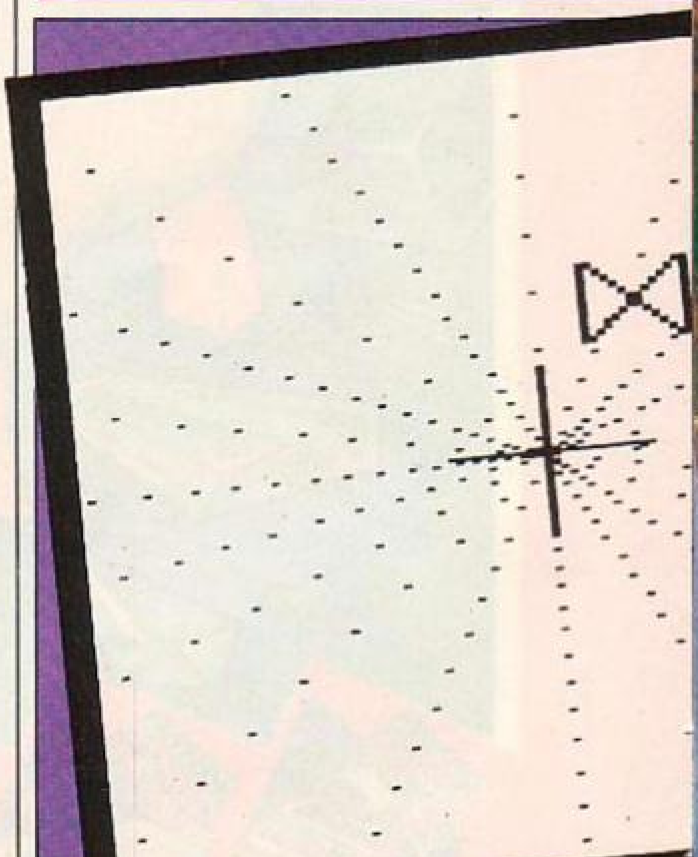
COSMIC CLASH

John Wilson takes you on a voyage across the universe in his armed-to-the-teeth starship.





COSMIC CLASH IS A games program for the BBC Micro Model B or Model A with 32K. The program is written in BBC Basic and machine code, to produce ultra fast, high-resolution graphics in true perspective. Before I go into how the program works, I will give a brief description of hdw to play the game.

You take the controls of a starship within an enemy galaxy. You are surrounded by 30 alien craft, which attack your ship one at a time. Your starship is fitted with a number of special attachments, as follows:

- Energy shield in front, back, left and right.
- Phaser weapon system.
- Photon torpedo launcher.
- Warp drive generator.
- Short range scanner.

These systems can be used by pressing either one or two keys as required. The different keys are as follows:

Key(s)	Use
W	Move starship upwards
X	Move starship downwards
A	Rotate starship direction left
D	Rotate starship direction right
S	Fire phaser banks
Space-bar	Fire photon torpedo
↑	Increase screen energy level
↓	Decrease screen energy level
f0	Select front energy screen
f1	Select back energy screen
f2	Select left energy screen
f3	Select right energy screen
f4	Short range scan
f5	Fire phasers
f6	Fire photon torpedo
f7	Increase screen energy level
f8	Decrease screen energy level
f9	Hyperspace jump

When the game starts, an alien craft will appear somewhere in the galaxy, which will probably be out of viewing range. Therefore, you must first turn your starship in order to face it, and then adjust your height until the alien is in the centre of the screen. While this is happening, the alien will probably be shooting at you. Therefore, before attempting combat, it is a good idea to put some energy into all the shields. This is accomplished by holding the two appropriate keys down. The energy for the shields is then removed from the main fuel energy. If your starship is hit and it has no protection, the starship will be destroyed.

You have a choice of two weapons systems available to you. Photon torpedoes automatically hit and destroy the target, but you only have a limited supply of these. The phasers must hit the centre of the enemy ship, in order to destroy it. As it takes a finite time for the phaser blast to reach its target, the enemy could have moved and avoided the shot.

Alternatively, you can escape from the enemy by using your warpdrive generators to enter Hyperspace. Unfortunately, this wears out the engines, so can only be used a few times.

Five types of alien craft

Once all 30 aliens have been destroyed, or avoided, you must aim your starship into the centre of the stargate, and into the next galaxy. Your ship will then be refueled and you will receive some more photon torpedoes.

There are five different types of alien craft which attack, in waves of six. Each craft gets progressively more dangerous, as they fire more often. Therefore, you have to keep one eye on your shield indicator, to keep each shield topped up, and try to destroy the enemy at the same time. This is no easy task, as it requires a lot of manual dexterity to control 18 buttons simultaneously!

```
10REM COSMIC CLASH  by J.R.Wilson
20PROCmc
30ENVELOPE2,3,0,0,0,0,0,0,126,-1,-2,-5,126,126
40VDU23,224,0,112,80,80,80,112,0,0
50VDU23,225,0,32,96,32,32,112,0,0
60VDU23,226,0,112,16,112,64,112,0,0
70VDU23,227,0,112,16,112,16,112,0,0
80VDU23,228,0,64,64,80,112,16,0,0
90VDU23,229,0,112,64,112,16,112,0,0
100VDU23,230,0,64,64,112,80,112,0,0
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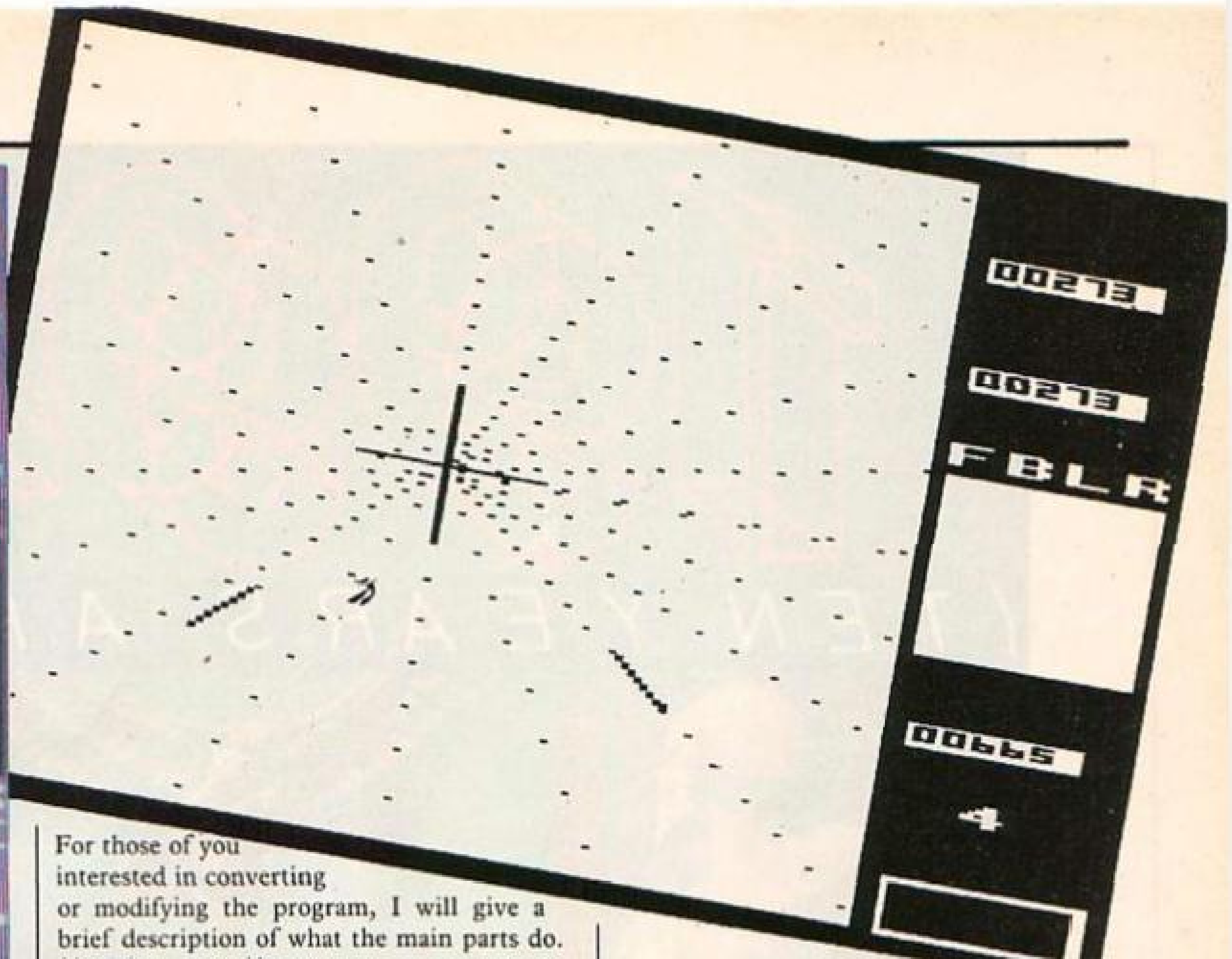
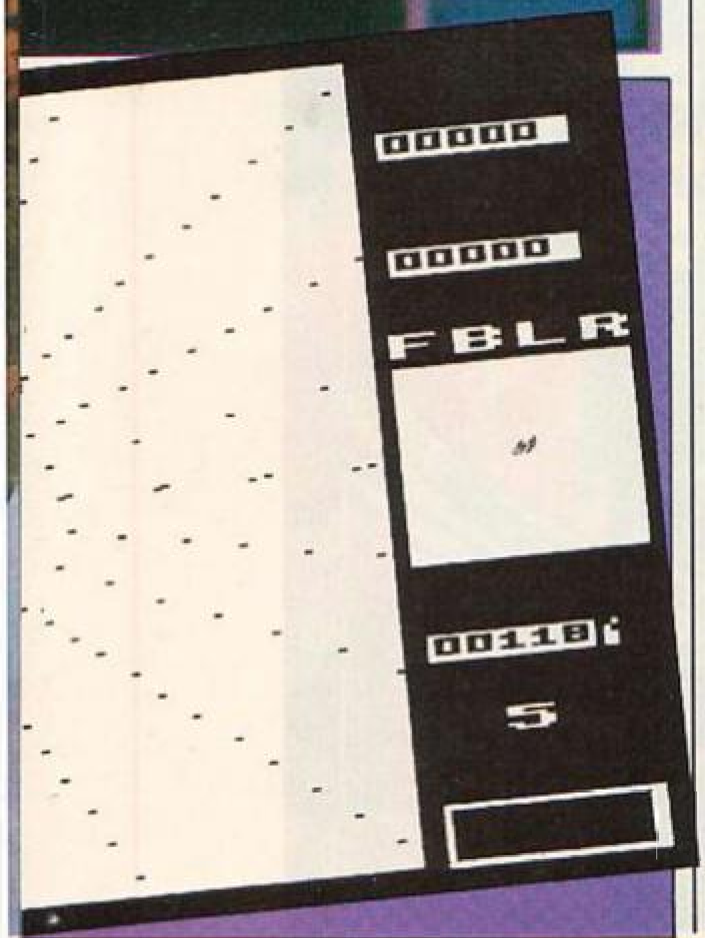
120VDU23,232,0,112,80,112,80,112,0,0
130VDU23,233,0,112,80,112,16,16,0,0
140VDU23,234,238,136,136,232,40,40,238,0
150VDU23,235,236,170,170,170,172,170,234,0
160VDU23,236,224,128,132,224,128,132,224,0
170VDU23,255,255,255,255,255,255,255,255,255
180ONERRORGOTO190
190REPEAT
200SC%=0:FU%=1000:HT%=0:FR%=0:BA%=0:RI%=0:LE%=0:to%=
5:HY%=3:CH=0
210MODE2:VDU19,5,0,0,0,0,23;8202;0;0;0;:COLOUR133:CL
S:COLOUR128:PROCS:CLG:PROCc
220GCOL3,1:MOVE200,700:VDU5:PRINT"S P A C E":MOVE140
,500:PRINT"B A T T L E":MOVE120,300:PRINT"by J.R.Wilso
n":VDU26:GCOL0,0
230FORI%=0TO110:MOVE1034+I%*2,30:DRAW1034+I%*2,100:N
EXT:VDU19,5,5;0;:GCOL0,4
240FORI%=0TO100:MOVE1045+I%*2,36:DRAW1045+I%*2,95:NE
XT:GCOL0,7
250MOVE1028,150:PRINT"Fuel":MOVE1048,950:VDU234,235,
236:MOVE1020,850:PRINT"HIGH":MOVE1052,800:VDU234,235,2
36:MOVE1020,700:PRINT"SHLD":MOVE1020,380:PRINT"STAR":M
OVE1020,340:PRINT"DATE":MOVE1020,250:PRINT"TORP"
260GCOL0,0:MOVE1020,660:PRINT"FBLR":MOVE1100,210:PRI
NT;5
270FORI%=-5TO110:MOVE1024,400+I%*2:DRAW1260,400+I%*2
```





For those of you interested in converting or modifying the program, I will give a brief description of what the main parts do.

Line(s)	*Use*
02	Set up machine code.
30	Define envelope for explosion
40 to 170	Define user characters for small numbers
180	Trap any errors in the program
200	Set up main vriables tor the game
210	Set up screen
220	Print title
230 to 270	Add all indicators to screen
280 to 290	Make an alien craft fly passed screen
300	Delete title
320 to 360	Main program loop
370 to 390	Your starship has been destroyed
400	Print your final score
410	Up date high score
420 to 430	Play another game if required
440 to 540	Read keyboard for key press
550	Reset colours 8 to 15 to black
560	Set up stars
570 to 580	Move stars
590	Time delay
600	Define graphics window
610	Update score
620	Print in small numbers
630 to 690	Modify forward shield energy
700 to 760	Modify back shield energy
770 to 830	Modify left shield energy
840 to 900	Modify right shield energy
910	Update star date
920 to 940	Update fuel level indicator
950 to 1000	Fire and move phaser shot
1010	Rotate starship to left
1020	Rotate starship to right
1030	Move starship upwards
1040	Move starship downwards
1050 to 1160	assemble machine code
1170 to 1250	Read in data for alien craft types
1260 to 1270	Set up alien craft position
1280	Plot alien craft
1290 to 1390	Move alien craft
1400	Check for alien fire
1410 to 1470	You are hit by alien fire
1480 to 1490	Check to see if alien craft is hit by phasers.
1500 to 1540	Alien craft is destroyed
1550 to 1580	Short range scanner
1590	Calculate position of alien craft relative to the starship's direction
1660	Plot a square
1610 to 1650	Try to go through star gate
1660 to 1680	Go through to next galaxy
1690 to 1700	Fir photon torpedo
1710 to 1760	Hyperspace jump

To fit the program into the limited memory required the loss of readability in the program. To save memory, I had to remove every unnecessary space, semi-colon and Then. I also had to put as much on one single line as possible. Therefore, when typing in the program do not add any spaces, etc., or you will run out of memory.

```
:NEXT:PROCP(1000,760,R%):PROCda:PROCsc:PROCss:PROCsa:P
ROCsh(AX%,AY%):SOUND0,17,7,255
  280FORI=0TO255STEP2:PROCms:SOUND&11,0,I,5:VDU19,1,I
MOD8+1;0;:GCOL3,2:IFI>0PROCsh(I*5-10,1006-I*3)
  290W%=W%+1:H%=H%+1:PROCsh(I*5,1000-I*3):NEXT:SOUND&1
0,0,0,0:PROCsc
  300GCOL3,1:MOVE200,700:VDU5:PRINT"S P A C E":MOVE140
,500:PRINT"B A T T L E":MOVE120,300:PRINT"by J.R.Wilso
n":VDU4,19,1,1;0;:GCOL0,1:MOVE400,516:DRAW600,516
  310MOVE500,416:DRAW500,616:DE%=FALSE:PROCsa
  320REPEAT:PROCms:PROCa:PROCk:IFINKEY-82ORINKEY-117PR
OCph
  330IFINKEY-118ORINKEY-99PROCto
  340IFINKEY-120PROChy
  350J%=J%+1:IFJ%MOD50=0PROCF(1)
  360UNTILDE%
  370SOUND&10,17,3,255:FORI%=255TO0STEP-1:SOUND&11,0,I
%,1:VDU19,5,RND(8);0;:NEXT:SOUND&10,0,0,0
  380*FX15,1
  390PROCde(200):MODE7:VDU31,5,5,130,141:PRINT"G A M E
 O V E R":VDU31,5,6,130,141:PRINT"G A M E  O V E R"
  400VDU31,3,10,129,141:PRINT"Your final score was:";S
C%:VDU31,3,11,129,141:PRINT"Your final score was:";SC%
  410IFSC%>=R%R%=SC%:VDU31,5,15,136,141:PRINT"The HIGH
 score !":VDU31,5,16,136,141:PRINT"The HIGH score !"
  420VDU31,10,20,133,141:PRINT"Another Game (Y/N) ?":V
DU31,10,21,133,141:PRINT"Another Game (Y/N) ?"
  430REPEAT:A$=GET$:UNTILA$="Y"ORA$="N":UNTILA$="N":CL
S:END
  440DEFPROCk:IFINKEY-66PROCl
  450IFINKEY-51PROCr
  460IFINKEY-67PROCd
  470IFINKEY-34PROCu
  480CU%=INKEY-58ORINKEY-23:CD%=INKEY-42ORINKEY-119
  490IFINKEY-33PROCfs:ENDPROC
  500IFINKEY-114PROCbs:ENDPROC
  510IFINKEY-115PROCls:ENDPROC
```

(listing continued on page 167)

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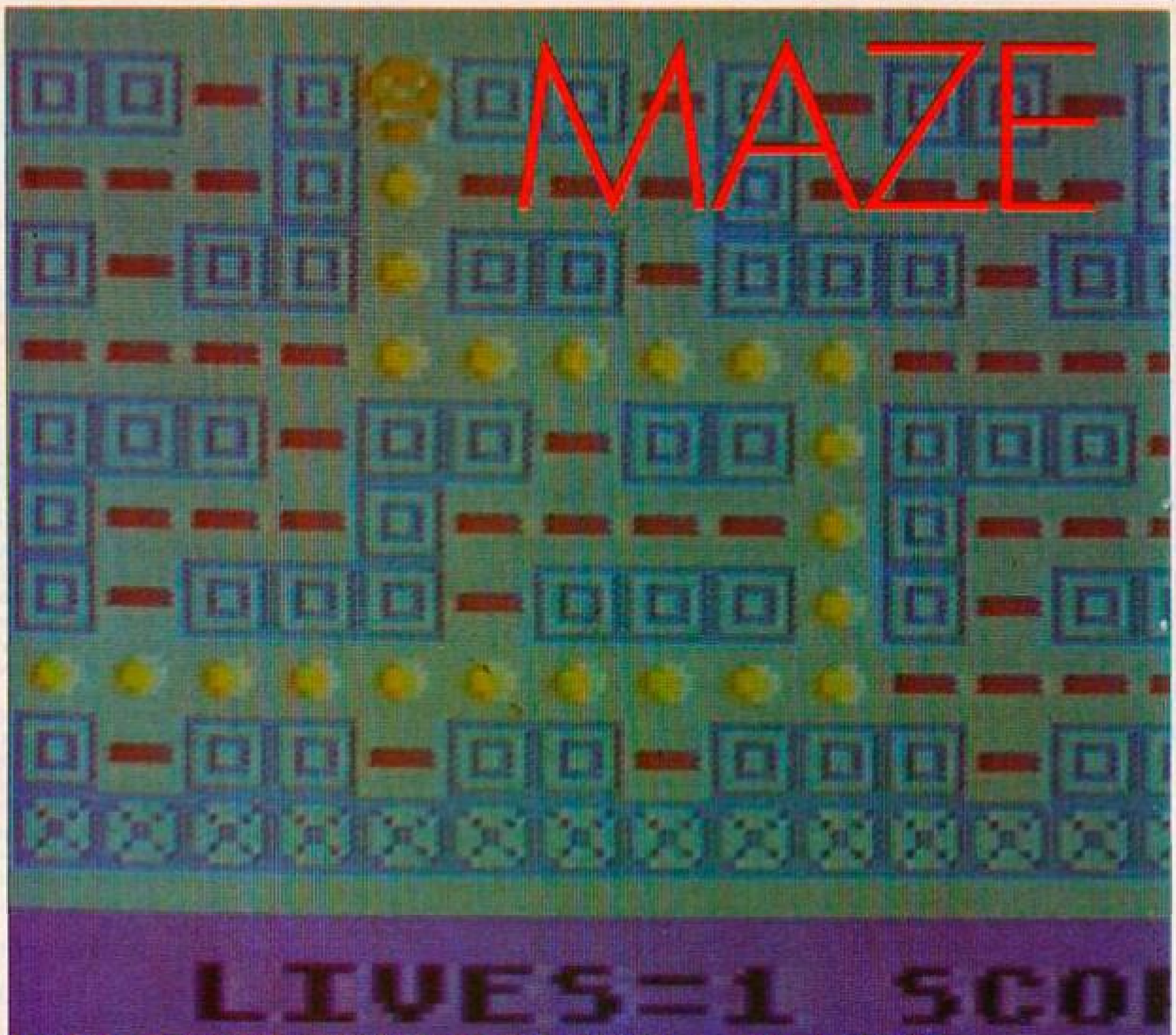
(listing continued from page 165)

```
  520IFINKEY-116PROCrs:ENDPROC
  530IFINKEY-21PROCsr:ENDPROC
  540ENDPROC
  550DEFPROCc:FORI%=8TO15:VDU19,I%,0;0;:NEXT:CL%=8:OC%
=8:ENDPROC
  560DEFPROCss:FORI=0TOPI*2STEPPI/10:D%=2:J%=RND(30):R
EPEAT:J%=J%+1:VDU19,1,J%MOD8 +1;0;:GCOL3,J%MOD8 +8:X%=
500+D%*COS(I)*1.5:Y%=512+D%*SIN(I):PLOT69,X%,Y%:D%=D%+
J%^1.2:UNTIL POINT(X%,Y%)=-1:NEXT:ENDPROC
  570DEFPROCms:CL%=CL%+1:IFCL%=16CL%=8
  580VDU19,CL%,7;0;19,OC%,0;0;:OC%=CL%:ENDPROC
  590DEFPROCde(T%):T%=TIME+T%:REPEATUNTILTIME>T%:ENDPR
OC
  600DEFPROCS:VDU24,32;32;1000;990;:ENDPROC
  610DEFPROCsc:PROCP(1000,900,SC%):IFSC%>R%R%=SC%:PROC
P(1000,760,R%):ENDPROC ELSEENDPROC
  620DEFPROCP(X%,Y%,A%):GCOL0,7:VDU26:FORI%=1TO5:MOVEX
%+I%*32,Y%:VDU5,9,&7F,224+A%DIV(10^(5-I%))MOD10,4:NEXT
:PROCS:ENDPROC
  630DEFPROCfs:IFNOTCU%ANDNOTCD%ENDPROC
  640IFCU%A%=1ELSEA%=-1
  650FR%=FR%+A%:IFFR%>100FR%=100:ENDPROC
  660IFFR%<0FR%=0:ENDPROC
  670VDU26:IFA%=-1GCOL0,0:MOVE1044,402+FR%*2:DRAW1076,
402+FR%*2
  680GCOL0,4:MOVE1044,400+FR%*2:DRAW1076,400+FR%*2
  690PROCF(A%):ENDPROC
  700DEFPROCbs:IFNOTCU%ANDNOTCD%ENDPROC
  710IFCU%A%=1ELSEA%=-1
  720BA%=BA%+A%:IFBA%>100BA%=100:ENDPROC
  730IFBA%<0BA%=0:ENDPROC
  740VDU26:IFA%=-1GCOL0,0:MOVE1100,402+BA%*2:DRAW1132,
402+BA%*2
  750GCOL0,4:MOVE1100,400+BA%*2:DRAW1132,400+BA%*2
  760PROCF(A%):ENDPROC
  770DEFPROCls:IFNOTCU%ANDNOTCD%ENDPROC
  780IFCU%A%=1ELSEA%=-1
  790LE%=LE%+A%:IFLE%>100LE%=100:ENDPROC
  800IFLE%<0LE%=0:ENDPROC
  810VDU26:IFA%=-1GCOL0,0:MOVE1156,402+LE%*2:DRAW1190,
402+LE%*2
  820GCOL0,4:MOVE1156,400+LE%*2:DRAW1190,400+LE%*2
  830PROCF(A%):ENDPROC
  840DEFPROCrs:IFNOTCU%ANDNOTCD%ENDPROC
  850IFCU%A%=1ELSEA%=-1
  860RI%=RI%+A%:IFRI%>100RI%=100:ENDPROC
  870IFRI%<0RI%=0:ENDPROC
  880VDU26:IFA%=-1GCOL0,0:MOVE1214,402+RI%*2:DRAW1246,
402+RI%*2
  890GCOL0,4:MOVE1214,400+RI%*2:DRAW1246,400+RI%*2
  900PROCF(A%):ENDPROC
  910DEFPROCda:PROCP(1000,300,TIME DIV100):ENDPROC
  920DEFPROCF(B%):FU%=FU%-B%:VDU26:GCOL0,4:MOVE1045+FU
%/5,36:DRAW1045+FU%/5,95:IFB%>0GCOL0,0:MOVE1045+FU%/5+
B%/5,36:DRAW1045+FU%/5+B%/5,95
  930IFFU%<1DE%=TRUE
  940PROCS:ENDPROC
  950DEFPROCph
  960PROCF(4):IFDE%ENDPROC
  970MX%=32:MY%=32:C%=15:GOTO990
  980GCOL3,7:MOVEMX%,MY%:DRAWMX%+64,MY%+64:MOVEMX%+C%*
64,MY%:DRAWMX%-64+C%*64,MY%+64:PROCk
  990MX%=MX%+32:MY%=MY%+32:C%=C%-1:IFC%=0PROCch:ENDPRO
C
 1000GCOL3,7:MOVEMX%,MY%:DRAWMX%+64,MY%+64:MOVEMX%+C%*
64,MY%:DRAWMX%-64+C%*64,MY%+64:SOUND&10,17,7,5:SOUND&1
1,0,C%*10,5:PROCms:PROCa:GOTO980
 1010DEFPROCl:GCOL3,2:PROCsh(FNH,AY%):YH%=YH%+3:PROCsh
(FNH,AY%):MX%=MX%+32:ENDPROC
 1020DEFPROCr:GCOL3,2:PROCsh(FNH,AY%):YH%=YH%-3:PROCsh
(FNH,AY%):MX%=MX%-32:ENDPROC
 1030DEFPROCu:GCOL3,2:PROCsh(FNH,AY%):AY%=AY%-32:PROCs
h(FNH,AY%):MY%=MY%-32:ENDPROC
 1040DEFPROCd:GCOL3,2:PROCsh(FNH,AY%):AY%=AY%+32:PROCs
h(FNH,AY%):MY%=MY%+32:ENDPROC
 1050DEFPROCmc
 1060FORI=0TO3 STEP2
 1070P%=&900:[OPTI
 1080LDY#1:LDA&80:LSRA:STA&81:LSRA:STA&82:LDA&88:LSRA:
STA&89:LSRA:STA&8A
 1090STY&83:STY&87:STY&8B:STY&8F:TYA:SBC&80:STA&84:TYA
:SBC&81:STA&85
 1100TYA:SBC&82:STA&86:TYA:SBC&88:STA&8C:TYA:SBC&89:ST
A&8D:TYA:SBC&8A:STA&8E
 1110LDALSB%,X:STA&75:LDAMSB%,X:STA&76:LDAnumber,X:STA
&7E
 1120LDY#0:.L1 LDA(&75),Y:STA&7F:LDA#25:JSR&FFEE:LDA&7
F:AND#128:CMP#128:BEQL2:LDA#0:JMPL3
 1130.L2 LDA#1:.L3 JSR&FFEE:LDA&7F:AND#7:TAX:LDA&80,X:
JSR&FFEE:LDAB1%,X:JSR&FFEE:LDA&7F
 1140LSRA:LSRA:LSRA:AND#7:TAX:LDA&88,X:JSR&FFEE
 1150LDAB1%,X:JSR&FFEE:INY:CPY&7E:BEQL4:JMPL1:.L4 RTS:
]
 1160LSB%=P%+10:MSB%=LSB%+5:number=MSB%+5:B1%=number+5
:NEXT
 1170C%=&A00:FORI%=0TO4:LSB%?I%=C%:MSB%?I%=C%DIV256:RE
ADA%:I%?number=A%:FORJ%=1TOA%:READB%:?C%=B%:C%=C%+1:NE
XTJ%,I%
 1180DATA5,45,131,160,131,164
 1190DATA11,45,131,43,152,43,131,46,150,182,178,146
 1200DATA9,30,45,137,141,41,153,137,35,141
 1210DATA7,13,171,169,137,156,24,139
 1220DATA9,157,174,10,137,171,153,170,14,141
 1230FORI%=0TO7:READA%:B1%?I%=A%:NEXT
 1240DATA0,0,0,0,255,255,255,0
 1250ENDPROC
 1260DEFPROCsa:YH%=RND(360)-180:AY%=RND(1600)-300:AT%=
HT%DIV6:AD%=RND(8):W%=15:H%=10:X%=AT%:AX%=FNH:MOVEAX%,
AY%:IFAT%=4ORAT%=3W%=20
 1270GCOL3,2:PROCsh(AX%,AY%):ENDPROC
 1280DEFPROCsh(A%,B%):?&80=W%:?&88=H%:X%=AT%:MOVEA%,B%
:CALL&900:ENDPROC
 1290DEFPROCa:GCOL3,2:PROCsh(FNH,AY%):W%=W%+1:H%=H%+1
 1300IFAD%<3ORAD%=8AY%=AY%-8
 1310IFAD%>3ANDAD%<7AY%=AY%+8
 1320IFAD%>1ANDAD%<5YH%=YH%+1
 1330IFAD%>5YH%=YH%-1
 1340PROCsh(FNH,AY%):IFYH%<-180YH%=180
 1350IFYH%>180YH%=-180
 1360IFRND(1)>.7AD%=RND(9)
 1370IFAY%>1300AY%=-300
 1380IFAY%<-300AY%=1300
 1390IFW%>250THEN1410
 1400IFRND(1)>CH ENDPROC
 1410GCOL3,5:MOVEFNH,AY%:DRAW500,30:FORI%=255TO0STEP-1
:SOUND&12,17,I%,1:NEXT:SOUND&10,2,6,10:D%=RND(4)
 1420IFYH%>=-45ANDYH%<45FR%=FR%-D%:A%=1044:B%=FR%
 1430IFYH%>44ANDYH%<136RI%=RI%-D%:A%=1212:B%=RI%
 1440IFYH%<-135ORYH%>135BA%=BA%-D%:A%=1100:B%=BA%
 1450IFYH%>-136ANDYH%<-45LE%=LE%-D%:A%=1156:B%=LE%
 1460VDU26:FORI%=1TOD%:GCOL0,0:MOVEA%,402+B%*2:DRAWA%+
32,402+B%*2:B%=B%+2:NEXT:PROCS:GCOL3,5:MOVEFNH,AY%:DRA
W500,30:IFB%-D%<1ORW%>250DE%=TRUE
 1470ENDPROC
 1480DEFPROCch:IFABS(FNH-MX%)>W%/2ORABS(AY%-MY%)>H%/2E
NDPROC
 1490PROCb:ENDPROC
 1500DEFPROCb
 1510SOUND&10,1,6,10:SC%=SC%+300-H%:PROCsc:GCOL3,2:PRO
Csh(FNH,AY%):PROCc:SOUND&10,2,6,20
 1520FORI%=8TO15:VDU19,I%,1;0;:PROCde(10):NEXT:FORI%=1
TO8:PROCms:PROCde(20):NEXT:PROCc:SOUND&10,0,0,0
 1530PROCda:HT%=HT%+1:IFHT%=30PROCdo
 1540PROCsa:CH=CH+.005:ENDPROC
 1550DEFPROCsr:GCOL3,7:A%=YH%-45:A$="Heading:  "+STR$(A
BSYH%):IFYH%<0A$=A$+" <"ELSEA$=A$+" >"
 1560B$="Range:  "+STR$(300-W%)+" Km":C$="Height:"+STR$
(ABSINT((AY%-500)/10))+" Km"
 1570IFAY%>500C$=C$+" ^"ELSEC$=C$+" v"
 1580VDU5:MOVE100,900:PRINTA$:MOVE100,850:PRINTB$:MOVE
100,800:PRINTC$:PROCda:FORI%=1TO20:PROCms:PROCde(20):N
EXT:GCOL3,7:VDU5:MOVE100,900:PRINTA$:MOVE100,850:PRINT
B$:MOVE100,800:PRINTC$:VDU4:ENDPROC
 1590DEFFNH:=(YH%+45)/9*100
 1600DEFPROCsq(A%,B%,C%):MOVEA%,B%:DRAWA%+C%,B%:DRAWA%
+C%,B%+C%:DRAWA%,B%+C%:DRAWA%,B%:ENDPROC
 1610DEFPROCdo:H%=0:W%=0:AT%=0:AY%=-1000:MX%=RND(1000)
:MY%=RND(1000):C%=10:REPEAT:GCOL3,7:IFC%<>10PROCsq(MX%
,MY%,C%)
 1620MX%=MX%+RND(8)-4:MY%=MY%+RND(8)-4:PROCk:C%=C%*1.1
:GCOL3,7:PROCsq(MX%,MY%,C%):PROCms:PROCde(10):UNTILC%>
300:PROCsq(MX%,MY%,C%)
 1630IFMX%<300ORMX%>700ORMY%<350ORMY%>500DE%=TRUE:ENDP
ROC
 1640C%=20:E%=8:SOUND&10,17,7,255:REPEAT:GCOL3,E%:PROC
sq(500-C%/2,500-C%/2,C%):C%=C%*1.2:E%=E%+1:IFE%=16THEN
E%=8
 1650UNTILC%>1000
 1660FORI%=1TO255:SOUND&11,0,I%,1:PROCms:PROCde(10):NE
XT:SOUND&10,0,0,0:C%=20:E%=8:REPEAT:GCOL3,E%:PROCsq(50
0-C%/2,500-C%/2,C%):C%=C%*1.2:E%=E%+1:IFE%=16THENE%=8
 1670UNTILC%>1000:GCOL3,7:MOVE300,500:VDU5:PRINT"B O N
 U S":B%=FU%*10:MOVE300,400:PRINT;B%:PROCde(500):MOVE3
00,500:PRINT"B O N U S":MOVE300,400:PRINT;B%:SC%=SC%+B
%:PROCsc:FU%=1000:GCOL0,4:VDU26
 1680FORI%=0TO100:MOVE1045+I%*2,36:DRAW1045+I%*2,95:SO
UND&13,17,I%,1:NEXT:HT%=0:to%=5:VDU5:MOVE1100,210:GCOL
0,5:VDU255,8:GCOL0,0:PRINT;5:VDU4:PROCS:ENDPROC
 1690DEFPROCto:IFto%=0ENDPROC
 1700GCOL3,5:MOVE500,30:DRAWFNH,AY%:PROCde(10):MOVE500
,30:DRAWFNH,AY%:to%=to%-1:PROCb:VDU26,5:MOVE1100,210:G
COL0,5:VDU255,8:GCOL0,0:PRINT;to%:VDU4:PROCS:ENDPROC
 1710DEFPROChy:IFHY%=0ENDPROC
 1720GCOL3,7:MOVE100,970:VDU5:PRINT"HYPERSPACE..":VDU4
 1730HY%=HY%-1:GCOL3,2:PROCsh(FNH,AY%):SOUND&10,17,7,2
55:FORI%=0TO255STEP2:SOUND&11,0,I%,5:PROCms:PROCde((25
5-I%)DIV10):NEXT:FORI%=1TO200:PROCms:PROCde(1):NEXT:SO
UND&10,0,0,0:IFHY%=0SOUND&13,2,100,20
 1740GCOL3,7:MOVE100,970:VDU5:PRINT"HYPERSPACE..":VDU4
 1750HT%=HT%+1:IFHT%=30PROCdo
 1760PROCsa:PROCda:ENDPROC
```

MAZE



Craig Stirling, with the help of his Atari, tries to remove landmines from their little pink boxes!

AT THE START of the Maze Miner the maze contains approximately 900 landmines, all in little pink boxes and completely safe. Your mission is simply to remove all the mines from their boxes. This is achieved by guiding the maze-miner around the maze using a standard joystick controller in the left most controller port.

Whenever maze-miner comes upon a boxed mine, he removes it from the box but at this stage the mine is still safe: this condition is depicted on screen by the presence of a yellow plus sign. It is perfectly alright to repass over these unarmed mines but when you do you inadvertently arm them and they are likely to explode if stepped on again: this condition is depicted by a red cross.

Armed mines do not always explode, in fact there is a better than 50 percent chance of survival and this percentage increases as the difficulty level rises; at level 26 — the highest level — you may cross and recross your path in almost perfect safety.

With you, in the maze, are a number of hunters whose task is to seek out and destroy you and then to refill the maze with boxed mines. The number of these hunters varies from four at difficulty level 1 to 29 at level 26. Just to add to your problems, the hunters travel faster as the difficulty level rises and wherever they go they leave armed mines behind them. This affects you in two ways:

- Since your score is calculated on the number of mines you remove from their boxes. Any mines removed by the hunters will lessen your possible score.
- Since they are leaving armed mines around you may find yourself cut off from a section of boxed mines and be forced to risk losing a life.

A further complicating factor is the extra-terrestrial observer or ETO. This fellow shows up from time to time and picks up the maze- miner to deposit him at random somewhere else in the maze and this too causes an armed mine to be left behind. This chap can be a bit of a nuisance when he lifts you from a safe area and dumps you in a dangerous part of the maze but he can also be helpful by performing the reverse role and moving you to a safer place. The ETO's visits become less frequent as the difficulty level rises and at levels greater than 20, they cease althogether.

The maze is some 15 times larger than the display screen so that only a portion of it is visible at any time. To move to other parts of the maze you use the joystick again but with the red button depressed. Once this button is pressed and the screen begins to scroll across the display window then all the other activities come to a stop it. The hunters will not move any closer to the maze-miner and the ETO will not appear.

Holding the button down with the joystick in the central position will therefore act as a sort of pause control but it should be noted that a game cycle will have to complete before the pause takes effect. A game cycle is as follows:

Step 1 . . . scroll the maze or pause whilever the red button is pressed.

Step 2 . . . move the maze-miner if required.

Step 3 . . . Move the hunters closer to maze-miner.

Step 4 . . . activate the ETO if due then return to step 1.

If the button is pressed during step 2, for example, then at that step and steps 3 and 4 will be processed before the button depression is sensed in step 1 on the next pass through.

You begin the game with five lives. Should you come into contact with a hunter or get unlucky with an armed mine then you will lose a life and the game will end when all your lives have been lost. You are, however, awarded extra lives at certain times. You get one bonus life for every 500 points you score and another if you succeed in unpacking the final box in the maze.

All movement on screen, with the exception of the ETO, is carried out by machine-code

Table 1.

DL Byte	Function
112 112 112	These three bytes are each 'blank 8 lines' commands and should be present in all display lists to correct for picture overscan at the top of the screen.
71	This is a combination of a 64 which is the LMS command and a 7 which tells Antic to assume Basic mode 2.
0 55	These two bytes specify the address from which the display is to start in low byte/high byte order.
71 52 55	This is the same sequence again but tells Antic to start displaying this line from a point in RAM 52 bytes on from the previous lines.
71 104 55	Save again 52 bytes further on from previous line.
71 156 55	Ditto
71 208 55	Ditto
71 4 56	Ditto
71 56 56	Ditto
71 108 56	Ditto
71 160 56	Ditto
240	This is a combination of a 112-blank 8 lines plus a 128 which signifies that a display list interrupt procedure is required.
112	This blanks 8 more lines to provide a separator.
71 0 51	This tells Antic to start displaying the score line from page 51 in store
65 195 63	This is jump and wait for vertical blank instruction. The following two bytes specify the start address of the display list.

routines but the main control functions have all been left in Basic to allow the user to tailor the program to his/her own needs and some suggestions are given later in this text.1

The program will fit into a standard 16K model 400 with a little room to spare but the user comtemplating changes and additions should be warned that although

PRINT FRE(0)

shows more than 4K available, more than 3K of this is actually used as display RAM and variable storage.

Some facilities have been embodied which are not readily available on other machines, even those with the same 6502 processor so I cannot offer any hints on conversion other than to say convert the hardware. The main special facilities used are: redefinable character sets, player-missile graphics — sprites, multiple dispay lists with the LMS instructions, display list interrupt procedures, relocatable screen RAM.

These are discussed individually below.

Redefinable character sets: Atari provides a standard character set in ROM but if any special characters are required then the set needs to be copied into RAM where it can be amended. Each character is defined in eight bytes each of which can be coded as a single number.

Player-missile graphics: In double-line resolution, the PMG area must start on a 1K boundary but if only the first player is used then the actual display area starts 1/2K further on and extends for 128 bytes. In a lot of listings I have seen, the unused sections of the PM area are not utilised at all and this could be misleading. There is no reason at all why the whole of the PMG area, except that 128 byte display area itself, should not be used for other purposes. To demonstrate, this program uses the first 512 bytes to hold the redefined character set. Part of the third page holds the player image which can then be copied to any part of the display area and the fourth page forms part of the maze display Ram.

At the end of the ETO cycle — the ETO is a player — the PM system is partially disabled and the player image is moved off-screen. Simply moving the player off-screen without disabling the PM system will save a little time when the player is next required to appear but it costs a lot of machine cycles to do it this way.

If the re-appearance of the player is not needed instantaneously then it is far more economical to partially disable the PMG system whenever the player is off-screen even though some extra code is needed at the start and end of the player cycle.

In this program DMA is switched on and off in each player cycle so that the 6502 has more real processing time available whenever the player is not wanted and this is most of the time. DMA stands for direct memory access and is used by the screen processor — ANTIC — to obtain its display data. This reduces the processing time of the 6502 by some 70,000 cycles per second.

Multiple display lists with LMS instructions: the Antic chip inside the Atari is not simply a television interface, it is a microprocessor in its own right. It has its own instruction set Albeit a small one, its own data and its own programs called display lists. A display list is simply a series of instructions and data which Antic uses to collect, interpret and organise its display data before passing it on to GTIA.

The LMS or Load Memory Scan instruction tells Antic where to start its display from. In RAM and how to interpret that data. This program has two separate display lists: the first simply emulates a normal graphics mode 2 display list but points Antic at an area of RAM which holds my text displays. The second is a bit more involved and is described in table 1.

Display List Interrupt Procesures: at the end of the maze display I invoke a display list interrupt procedure or DLI. The function of this procedure is to overcome the limits on the number of colours in graphics mode 2. Let me explain:

In mode 2 Antic takes the first 2 bits of each screen RAM byte to identify the colour register to be used — 0 to 3. The other six bits define the character. Thus only four colours plus the background colour are normally available in this mode. However the hardware colour registers have 'shadow' registers in RAM and it is these shadows that the setcolor command updates.

During the vertical blank period the OS copies these shadows across to the hardware colour registers that Antic uses. My DLI procedure changes the value of two of these hardware registers directly so that two extra colours are made available for the score line. The sequence of events now looks something like this:

- During VBI the OS copies the shadow registers across for Antic to use thus setting up the basic five colours.
- Antic displays the maze using these five colours until a DLI is reached
- The DLI is actioned and writes new values into two the the hardware registers.
- Antic displays the remainder of the screen using the new values thus effectively giving seven different colours on the screen at once.
- At the end of the display the VBI is re-entered and the shadow registers are copied across again thereby restoring the original five colours ready for displaying the maze again.

It is of course possible to have a DLI actioned at the end of other lines if required and use them to get up to 128 different colours at once.

Relocatable Screen RAM: through the medium of the LMS instruction in the display list it is quite possible to instruct Antic to display any part of RAM and to as ume any mode. This also enables you to have several different Basic_Antic modes on the screen at the same time although sometimes the OS has to be helped along a little to cope. This is an extremely useful facility which can be used to enrich many displays.

The facility I use more than any other is to write direct to the display area specifying both the character and its colour register in a single Poke. There is, of course, a facility for doing this via the setcolour command but I find that direct Poke much easier to use and it is probably more efficient. To use the setcolour command, you first look up the character in one table and note which column it is in. You then look at a second table in the corresponding column and obtain a number which needs to be added to or subtracted from the character number. You can then supply this number to the setcolour command or even

PRINT(ASC(n))

To Poke direct to RAM in mode 2 you simply Poke the desired location with the character number if the colour in register 0 is required or add 64 for colour register 1 or 128 for colour register 2 or 192 for colour register 3. In this program I tend to use store locations direct for almost everything other than the control parameters which, as stated previously, I have left in Basic using named variables to allow user tailoring. I have kept clear of the more normal forms of animation but this option is left open to the user.

While the program has been written with user tailoring very much in mind, I feel I should give another warning about store availability. If the Usr loads the program and then types

PRINT FRE(0)

he will be informed that more than 4K is free. This is not the case. The program itself uses 3.25K at the top end of store which the OS does not know about.

Having said that, there are a further couple of suggestions I would like to make that should not cause any problems:

The fundamental control parameter is DIFF but this is very often qualified in some way eg.

DIFF/7

These qualifiers have all been made simple and I would urge the user to experiment by changing some or all of them which will

(continued on page 171)

(continued from page 169)
certainly affect the nature of the game.

As written, the maze is reset whenever a life is lost which reduces the chances of completing the mission. It is possible to avoid this and leave the mine and hunter status unchanged after a lost life. The amendment is to replace the

GOSUB RST:GOSUM REH

in line 780 — where the loss of life is self-inflicted — and/or in line 1040 — where a hunter gets you — and replace these by:

GOSUB 27000

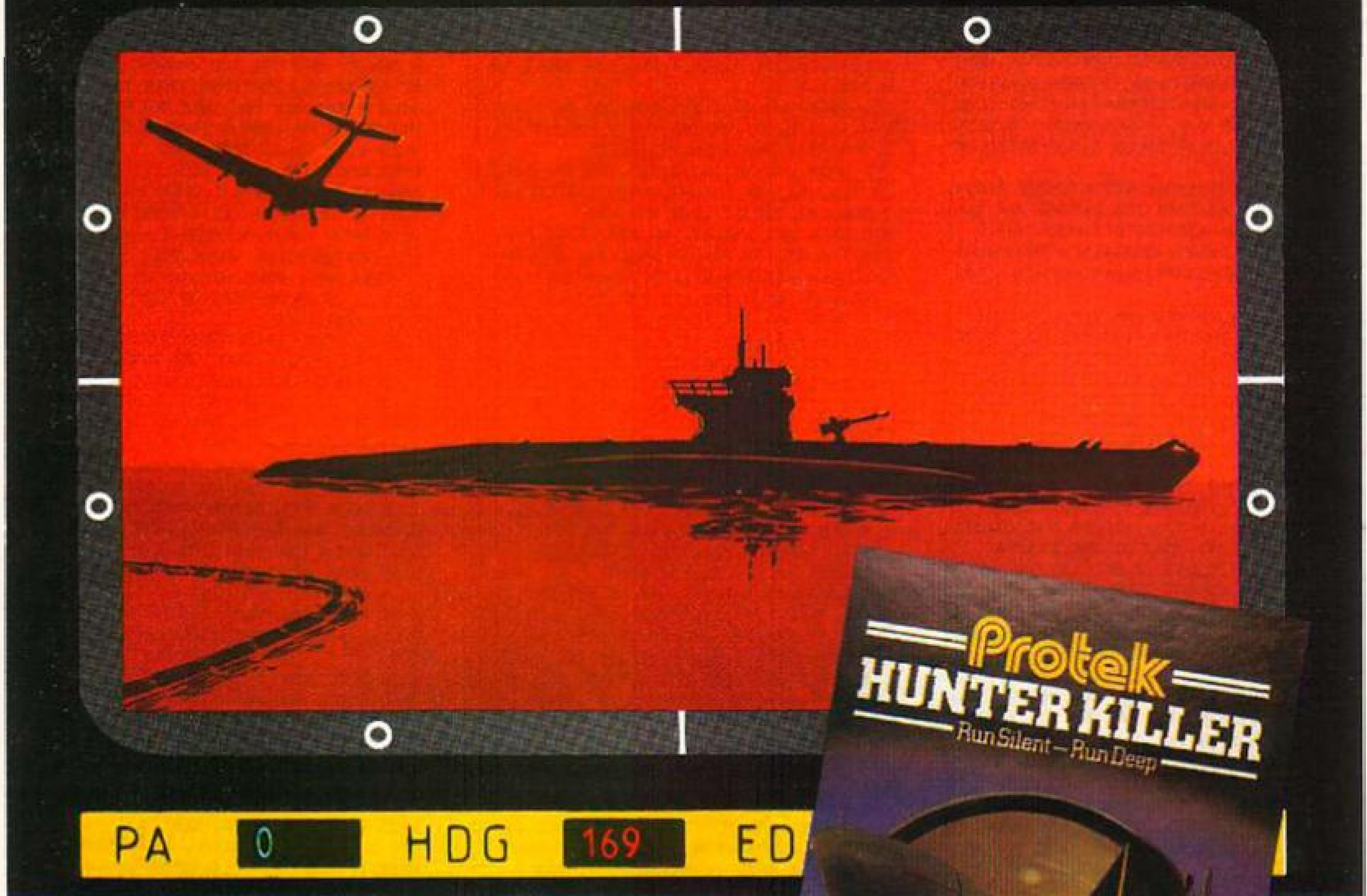
and insert:

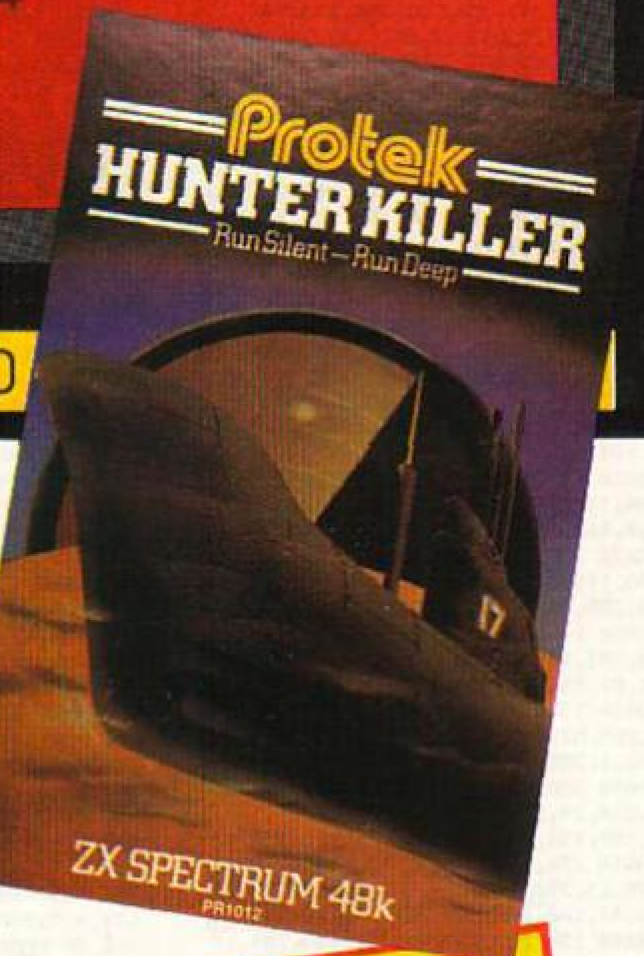
2700 A = SBAS + (PEEK(185) – 1)*52 + PEEK(184) – 1:POKE A,198:RETURN

```
10 SDM=559:GRAPHICS 18:POKE SDM,0:LIV=
5:BON=500:SCO=0:SBAS=14080:BOR=65:MBAS
=14133:HUN=9:MAZ=8:SDL=20000:LDL=21000
20 RST=22000:REH=23000:RSM=24000:PSL=2
5000:SETCOLOR 0,1,10:SETCOLOR 1,8,8:SE
TCOLOR 2,14,12:SETCOLOR 3,3,8:SETCOLOR
 4,0,10
30 POKE 206,135:POKE 207,63:POKE 208,1
65:POKE 209,63:POKE 203,1:POKE 204,1:H
XB=16263:HYB=16293:DIFF=1:POKE HXB,0
40 POKE 205,1:BUTT=53264:DLY=26000:DEB
UG=27000:CONS=53279:TAB=1760:PCOL=704:
GRA=53277
100 DATA 166,189,160,55,169,0,24,101,1
88,56,233,1,202,240,8,24,105,52,144,24
8,200,208,245,133,254,132,255,96
110 DATA 104,208,27,165,184,133,186,16
5,185,133,187,173,120,2,201,14,240,13,
201,13,240,15,201,7,240,19,201,11
120 DATA 240,23,96,198,187,240,251,208
,20,230,187,201,32,240,243,208,12,230,
186,201,52,240,235,208,4,198,186,240
130 DATA 229,165,186,133,188,165,187,1
33,189,32,0,6,162,0,161,254,201,65,240
,210,201,71,240,206,201,198,240,14
140 DATA 201,9,240,17,201,132,240,22,3
2,225,6,240,43,96
150 DATA 173,10,210,201,127,144,35,169
,1,133,212,169,0,133,213,96,162,0,169,
8,129,254,165,184,133,188,165
160 DATA 185,133,189,32,0,6,162,0,169,
198,129,254,24,144,23,162,0,169,8,129,
254,165,184,133,188,165,185,133,189
170 DATA 32,0,6,162,0,169,132,129,254,
165,186,133,184,165,187,133,185,134,21
2,134,213,96,72,138,72,169,80,162,88
175 DATA 141,10,212,141,22,208,142,26,
208,104,170,104,64,104,169,0,133,213,1
73,128,63,208,8,173,129,63,240,12,206
176 DATA 129,63,206,128,63,169,0,133,2
13,240,4,169,2,133,212,96,104,201,3,20
8,48,104
180 DATA 133,198,104,133,197,104,133,2
00,104,133,199,104,133,202,104,133,201
,160,0,165,201,208,6,165,202,240,20
190 DATA 198,202,177,197,145,199,198,2
01,200,192,0,208,235,230,198,230,200,2
4,144,228,96
200 DATA 104,208,19,173,120,2,201,14,2
40,13,201,13,240,48,201,7,240,87,201,1
1,240,81,96,166,204,202,240,250
210 DATA 134,204,162,4,160,0,56,189,19
5,63,233,52,157,195,63,144,5,232,232,2
32,176,6,232,222,195,63,232,232
220 DATA 200,192,10,208,229,96,166,204
,232,224,24,240,248,134,204,162,4,160,
0,24,189,195,63,105,52,157,195,63
230 DATA 176,5,232,232,232,144,6,232,2
54,195,63,232,232,200,192,10,208,229,9
6,240,41,166,203,232,224,34,240,246
240 DATA 134,203,162,4,160,0,24,189,19
5,63,105,1,157,195,63,176,5,232,232,23
2,144,6,232,254,195,63,232,232,200
250 DATA 192,10,208,229,96,166,203,202
,240,250,134,203,162,4,160,0,56,189,19
5,63,233,1,157,195,63,144,5,232
260 DATA 232,232,176,6,232,222,195,63,
232,232,200,192,10,208,229,96,104,201,
1,240,1,96,104,104,133,192,198,192
270 DATA 48,247,160,0,177,206,240,246,
133,195,177,208,240,240,133,196,197,18
5,240,18,176,10,230,196,169,13
275 DATA 141,132,63
280 DATA 24,144,24,198,196,169,14,208,
244,165,195,197,184,176,6,230,195,169,
7,208,232,198,195,169,11,208,226
290 DATA 165,195,133,188,165,196,133,1
89,140,134,63,32,0,6,172,134,63,162,0,
161,254,201,65,240,27
295 DATA 201,71,240,23,201,8,208,9,169
300 DATA 1,133,212,169,0,133,213,96,20
1,197,208,59,32,225,6,240,54,96
310 DATA 173,132,63,201,14,240,32,201,
13,240,24,201,7,240,4,230,195,208,2,19
8,195,165
320 DATA 205,73,1,133,205,240,3,76,155
,62,76,145,62,198,196,208,2,230,196,16
5,205,73,1,240,3,76,173,62,76
330 DATA 167,62,162,0,165,195,141,130,
63,165,196,141,131,63,169,9,129,254,17
7,206,133,188,177,208,133,189
335 DATA 142,133,63,140,134,63,32,0,6,
174,133,63,172,134,63,169,198,129,254
336 DATA 173,130,63,145,206,173,131,63
,145,208,169,0,133,212,133,213
340 DATA 200,201,30,208,3,76,121,62,76
,127,62,112,112,112,71,0,55,71,52,55,7
1,104,55,71,156,55,71,208,55,71,4
350 DATA 56,71,56,56,71,108,56,71,160,
56,71,212,56,240,112,71,0,51,65,195,63
,112,112,112,71,0,51,7,7,7,7,7,7
360 DATA 7,7,7,7,7,65,236,63,66,195,15
3,165,255,153,195,66,255,195,165,153,1
53,165,195,255,0,0,24,60,60,24,0,0,0
370 DATA 0,0,126,126,0,0,0,0,0,68,40,1
6,40,68,0,255,129,189,165,165,189,129,
255,60,126,219,231,126,66,60,60,0,0
380 DATA 24,126,90,231,60,0
400 DATA 197,197,197,197,71,197,197,19
7,197,71,197,71,71,197,71,197,71,71,19
7,71,197,197,197,197,71,197,197,197
410 DATA 197,71,71,71,197,71,71,197,71
,71,197,71,197,197,197,197,197,197,197
,197,197,197,197,71,71,71,197,71,71
420 DATA 197,71,71,197,71,197,197,197,
71,197,197,197,197,197,71,197,71,71,71
,197,71,71,71,197,197,197,197,197
430 DATA 197,197,197,197,197,71,71,197
,71,71,197,71,71,197,71
500 FOR I=1536 TO 1791:READ A:POKE I,A
:NEXT I:L=15744:FOR I=L TO 16225:READ
A:POKE I,A:NEXT I:MM=1564:SS=15798
510 A=USR(L,HXB,HXB+1,59):FOR I=16373
TO 16383:READ A:POKE I,A:NEXT I:FOR I=
14072 TO 14079:READ A:POKE I,A:NEXT I
520 MH=15983:A=USR(L,57344,13312,512):
FOR I=13320 TO 13327:READ A:POKE I,A:N
EXT I:FOR I=13344 TO 13391:READ A
530 POKE I,A:NEXT I:POKE 756,52:GOSUB
10000:POKE SBAS,BOR:A=USR(L,SBAS,14081
,51):A=USR(L,SBAS,15692,52)
540 FOR I=14131 TO 15692 STEP 52:POKE
I,BOR:POKE I+1,BOR:NEXT I:GOSUB RST:GO
SUB RSM
600 PMB=54279:POKE PMB,52:POKE PCOL,16
8:HPOS=53248:POKE HPOS,0
700 POKE 203,1:POKE 204,1
705 POSITION 0,9:PRINT #6;"HIT SELECT
FOR DIFF":PRINT #6;"THEN PRESS START K
EY"
706 POSITION 0,11:PRINT #6;"   DIFFICU
LTY = ";DIFF;" ":FOR I=1 TO 100:NEXT I
710 IF PEEK(CONS)=5 THEN DIFF=DIFF+1:I
F DIFF>26 THEN DIFF=1
715 IF PEEK(CONS)<>6 THEN 706
720 IF DIFF>26 THEN DIFF=26
725 GOSUB REH:GOSUB LDL:POKE 1666,DIFF
*5+125
730 GOSUB PSL:IF PEEK(BUTT)=0 THEN A=U
SR(SS):GOTO 730
740 OSC=PEEK(16256):A=USR(MM)
745 IF A=0 THEN SOUND 0,128,14,10:IF P
EEK(16256)<>OSC THEN SCO=SCO+INT(DIFF/
3)+1
746 IF SCO>BON THEN LIV=LIV+1:BON=BON+
500
750 IF A=0 THEN GOSUB DLY:SOUND 0,0,0,
0:GOTO 1000
760 IF A=2 THEN LIV=LIV+1:DIFF=DIFF+1:
GOSUB 6000:GOTO 720
770 IF A<>1 THEN 1000
780 GOSUB SDL:POSITION 6,4:? #6;"NICE
MOVE":POSITION 2,9:? #6;"YOU LOSE ONE
LIFE":GOSUB RST:GOSUB REH:GOSUB 7000:G
OSUB RSM
790 LIV=LIV-1:IF LIV=0 THEN 5000
800 GOSUB LDL:GOTO 730
1000 R=INT(RND(0)*120):IF R<DIFF THEN
ITE=INT(DIFF/7)+1:A=USR(MH,ITE)
1005 IF A=0 THEN 1200
1010 IF A=2 THEN DIFF=DIFF+1:GOSUB 600
0:GOTO 720
1020 IF A<>1 THEN 1200
1035 GOSUB SDL:POSITION 0,0:PRINT #6;"
A HUNTER HAS GOT YOU":POSITION 6,5:PRI
NT #6;"HARD LUCK":POSITION 3,9
1040 PRINT #6;"YOU LOSE A LIFE":GOSUB
RST:GOSUB REH:GOSUB 7000:GOSUB RSM:LIV
=LIV-1:IF LIV=0 THEN 5000
1050 GOSUB LDL:GOTO 730
1200 IF RND(0)*100>1 THEN 730
1205 IF INT(RND(0)*21)<DIFF THEN 730
1210 POKE 13824,0:A=USR(L,13824,13825,
127):XD=PEEK(184)-PEEK(203):YD=PEEK(18
5)-PEEK(204):POKE HPOS,0:TX=XD*8+47
1215 IF YD>9 OR YD<0 OR XD>19 OR XD<0
THEN GOTO 1260
1220 TY=YD*8+16:A=USR(L,14072,13824+TY
,8):POKE SDM,46:POKE GRA,3:R=45
1230 R=R+1:POKE HPOS,R:SOUND 1,255-R,1
4,10:IF R<>TX THEN GOTO 1230
1240 POKE PCOL,254:A=SBAS+(PEEK(185)-1
)*52+PEEK(184)-1:POKE A,198:GOSUB RSM
1250 R=R+1:POKE HPOS,R:SOUND 1,255-R,1
4,10:IF R<210 THEN GOTO 1250
1260 POKE HPOS,0:POKE PCOL,168:POKE GR
A,0:POKE DMA,34:SOUND 1,0,0,0:GOTO 730
5000 GOSUB SDL:POSITION 0,0:? #6;"  EN
D OF GAME":POSITION 0,3:? #6;"YOU SCOR
ED ";SCO:POSITION 0,5
5010 PRINT #6;"AND REACHED LEVEL ";DIF
F:LIV=5:BON=500:SCO=0:GOSUB RST:GOSUB
RSM
5020 GOTO 705
6000 GOSUB SDL:POSITION 0,0:PRINT #6;"
THE MAZE IS CLEAR":POSITION 0,3:PRINT
#6;"WELL DONE INDEED":POSITION 0,5
6005 IF DIFF>26 THEN DIFF=26
6010 PRINT #6;"LEVEL IS NOW ";DIFF:GOS
UB RST:GOSUB RSM:RETURN
7000 FOR I=0 TO 255:SOUND 1,I,14,10:SO
UND 2,255-I,14,10:FOR K=1 TO 5:NEXT K:
NEXT I:SOUND 1,0,0,0:SOUND 2,0,0,0:RET
URN
10000 GOSUB SDL:POSITION 0,0:? #6;"CHA
RACTERS USED":POSITION 0,2:? #6;"MAZE
MINER       ("
10010 ? #6;"HUNTER           )":? #6;"M
AZE WALL        "":? #6;"MAZE LIMIT
  !":? #6;"SAFE MINE        $"
10020 ? #6;"ARMED MINE       &":? #6;"B
OXED MINE       %":RETURN
20000 POKE SDM,0:GOSUB 28000:POKE 560,
236:POKE 561,63:POKE 87,2:POKE 88,0:PO
KE 89,51:POKE SDM,34:RETURN
21000 POKE SDM,0:POKE 560,195:POKE 561
,63:POKE 87,2:POKE 88,0:POKE 89,51:POK
E 512,204:POKE 513,6:POKE 54286,192
21005 POKE SDM,34:RETURN
22000 RESTORE 400:N=0:FOR J=1 TO 10:FO
R I=MBAS+N TO 14142+N:READ A:POKE I,A:
NEXT I
22010 A=USR(L,MBAS+N,14143+N,40):N=N+5
2:NEXT J:A=USR(L,MBAS-1,14652,1040):PO
KE 16257,3:POKE 16256,131
22020 RETURN
23000 POKE HXB,0:A=USR(L,HXB,HXB+1,59)
23005 FOR I=0 TO 2+DIFF
23010 X=INT(RND(0)*50)+2:Y=INT(RND(0)*
30)+2:A=SBAS+(52*(Y-1)+(X-1)):IF PEEK(
A)<>197 THEN 23010
23020 POKE A,HUN:POKE HXB+I,X:POKE HYB
+I,Y:A=USR(TAB):NEXT I:RETURN
24000 X=INT(RND(0)*50)+2:Y=INT(RND(0)*
30)+2:A=SBAS+(52*(Y-1)+(X-1)):B=PEEK(A
):IF B=71 OR B=9 THEN 24000
24010 POKE A,MAZ:POKE 184,X:POKE 185,Y
:IF B=197 THEN A=USR(TAB)
24020 RETURN
25000 POSITION 0,0:? #6;"  LIVES=";LIV
;" SCORE=";SCO;"   ":RETURN
26000 FOR I=1 TO 28-DIFF:NEXT I:RETURN

28000 POKE 13056,0:A=USR(L,13056,13057
,255):RETURN
```

SEEK AND DESTROY.





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RESPONSE FRAME

Do you have a problem? Your manual is incomprehensible or you just cannot get the hang of that programming trick you tried — whatever it is, Tim Hartnell will do his best to answer your queries. Please include only one question per letter and mark them "Response Frame".

CONVERSION

I recently successfully load and ran a Vic-20 program from *Your Computer*. However, I wish to convert it so that it works with a joystick, as I find the keyboard controls awkward to operate.

J S Molineux, Frodsham, Cheshire.

TO CONVERT KEYBOARD programs to joystick operation you need two things: an understanding of the effect of each key press in the keyboard version; and a routine to read the joystick, so the effects of the keypresses can be converted into the appropriate outputs from the joystick. The first of these — the effect of relevant key presses — can only be ascertained from the program.

A routine for reading the joystick is given in the *Vic-20 Programmers' Reference Guide*.

MISSING GRAPHICS

Our user-defined graphics seem to have disappeared on our Spectrum. When we press Capshift and G — for graphics — followed by A, the expected graphic does not appear. Please explain how we can get our user-defined graphics back.

J and A Thompson, Richterswil, Switzerland

IT SEEMS THAT you are not following the correct procedure for getting into Graphics Mode. The G cursor — indicating that you are in the required mode — occurs after Graphics — Capshift and 9 — is pressed — note, 9, not G — and lasts until it is pressed again — see page 147 of the manual.

Of course, you need to have defined a graphic before it will show up on the screen — see chapter 14 of the manual. If you are doing this, and the user-defined graphics still do not appear, your computer may be having trouble accessing the area of RAM where the user-defined graphcis are stored. If this is the case, you should get in touch with your local Sinclair agent.

WHAT'S THE USE

Please can you explain the use of a dimensional array containing four numbers, such as DIM A$(2,3 4,5).

T Baker, Fareham, Hampshire.

ANY ARRAY IS used to store a *list* of information, in which any item on the list can be referred to simply by referring to its *position* within the list.

Although I can fiarly easily define what an array is, in words like the above, to define the *use* of an array is not so simple, as the application of the array depends on the program in which it appears. The main advantage of multi-dimensional arrays — such as the one you mention in your question — is that *related* groups of data can be held in array elements which can be referenced as a group, by — for example — referring to the first element of the array.

A(1,X,Y,Z) could be an array where all the elements which begin A(1 . . .) referred to numbers of people, while all elements which begin A(2 . . .) referred to amounts of money. In your question, you give a string array as your example. The only difference between a string and a numeric array — such as I've been discussing — is that a string array will hold string information — such as "London Town" — rather than numeric information. However, despite this difference in the nature of the information held, the same advantage — of having related items of data with common 'master elements' within the array — holds for both string and numeric information.

THE BEST CPU

My question regards microprocessors. I own a Video Genie which has, a Z-80 CPU. I can program in assembly language on my machine but am now wondering whether to buy a new home computer with high resolution graphics and colour. The computers I have looked at have either a Z-80 or a 6502 — with a few which use the 6809. Please could you state the advantages and disadvantages of the 6502 or 6809 compared with the Z-80, in the eyes of the hobbyist? Then, if possible, come up with a conclusion as to which is the best for a hobbyist to program on. Do all the current crop of computers have a future in the next decade?

Ashish Sekhri, Gateshead, Tyne and Wear.

THE ACTUAL PROCESSOR used within a computer is not a vital consideration when purchasing a machine and certainly should not be the primary factor. I would suggest that, as you already know assembly language programming on the Z-80, you stick to a Z-80 — or Z-80A — computer, making use of your present knowledge.

The Spectrum immediately suggests itself as a suitable machine, although I am *not* suggesting that you buy this without examining the other excellent machines which are around. However, the Spectrum uses the processor you know, it is relatively inexpensive, a number of assemblers are available for it, and is capable of the most outstanding effects when expertly programmed.

If you want the advantage of a built-in assembler, with the ability to call assembly language routines within a Basic program, you might want to look at the BBC Micro or the Electron, among others.

As to your statement about the computers which 'have a future over the next decade' I would be prepared to bet on very few present companies even being in the computer field with the exception of IBM — and possibly Sinclair, Acorn, Commodore and Apple. Ten years is so far away in computer terms it does not merit consideration as a factor which can colour your choice of microcomputer in 1984.

UPGRADE PROBLEM

I own a 16K Spectrum. A couple of weeks ago I went into a local store and bought myself a 32K RAMpack. I got back home, and tried it out. I worked, but when I tried to load a 48K program — Football Manager. I kept on getting the message 'Out of Data'. I tried it with a number of my friend's 48K programs and each time got the same answer. I took the RAMpack back and got my money back. What should I buy to turn my 16K machine into a 48K one, if the upgrade kits do not work?

C Oliver, Chesterfield, Derbyshire.

I THINK YOU EITHER bought a defective RAMpack with some non-working memory chips, or else you did not install it correctly. It would have been more useful to swap the pack you bought for another, and then try that, rather than just asking for your money back. 48K Spectrum upgrade kits are just that — kits to upgrade a 16K machine into a 48K one. I have heard good reports about the brand you mention, and several others. Certainly, other purchasers have not given the same report you have. I suggest you go and buy another pack — not necessarily from the same firm, and possibly from Sinclair — and if you cannot get this one to work correctly, get in touch with the manufacturer directly.

ANAGRAM PROGRAM

IN A RECENT ISSUE OF *Your Computer*, Tim Hartnell gave very reasonable suggestions to G Smith who sought a program to print out every anagram of a given seven-letter word, writes W E Thomson of Woodhaven, Aldeburgh.

He continues: a ZX-81 Spectrum program to do precisely what was asked exists, but anyone using it might end up feeling like the Sorcerer's Apprentice for, even at 88 anagrams to the screen, 58 screenfulls are needed to finish the job.

Here is a simpler program that produces random anagrams of a seven-letter input. It illustrates the technique for permutating strings:

```
10 INPUT A$
20 PRINT A$;" ";
30 FOR I = 7 TO 1 STEP -1
40 LET Q = 1 + INT(RND*I)
50 LET A$ = A$(TO Q - 1) +
   A$(Q + 1 TO) + A$(Q)
60 NEXT I
70 GOTO 20
```

BEST BASIC

I do not think I am the only reader who has this problem: which machine should I upgrade to. I have started off 18 months ago with a Vic-20 and have added the Super Expander cartridge. My principle interest is in graphics, particularly 3-D. CAD/CAM-type applications such as are possible on small micros. I nearly bought the Commodore 64, having got used to Commodore Basic, but now am not so sure I should do this. It seems from the advertisement which *Your Computer* runs, that only two machines have good software for 3-D graphics, and they are the Spectrum and the BBC. Which would you advise? Also, which Basic is "better", Sinclair or BBC.

Tom Coodearl, Wellbourne, Cuddesdon.

QUESTIONS OF the "which computer should I buy?" type nearly always receive an answer which begins "It all depends . . " And it does. It depends on how much money you wish to spend, how easily you believe you will adapt your currnt programming skills to a "foreign" Basic, and the principle uses you envisage for your microcomputer.

You cover most of these points in your question. If you are familiar with Commodore Basic, and you are willing to continue with a Basic which is distinctly non-user-friendly, in demanding such things as *nine* Pokes to produce a single note instead of a Sound or Play command, you should perhaps stick with that.

However, if, as in your case, graphics are one of your main interests — and the price does not bother you — it may be best to abandon the dialect you know and strike out for the BBC Micro.

The Spectrum, by contrast, though extremely easy to use, demands a higher degree of programming skill in order to get sophisticated graphics. In general, Sinclair Basic is extremely easy to use because of the one-touch key word entry system, and the syntax checking but it also somewhat limited in comparison to several other Basics. To decide which computer to buy, you will need to determine where your priorities lie.

SOFTWARE FILE

Software File gives you the opportunity to have your programs, ideas and discoveries published. We will accept contributions for any home computer provided they are submitted to *Your Computer* exclusively. Please double-check your programs and specify the memory they require before sending them, preferably on cassette. We pay between £6 and £36 for contributions published.

Lifter

C Stewart,
South Shields,
Tyne and Wear.

SPECTRUM

THIS GAME for the 16K or 48K Spectrum involves reaching the top of a multi-level building where a mean gorilla has captured your heart-throb Jane.

In order to rescue Jane you must cross bridges, avoid fire-balls, and step safely on to a lift which moves upwards constantly. When a bridge is crossed it disappears and leaves a hole. From then on you must jump the space where the bridge was and try to avoid falling into a bottomless pit to your death.

Using the M and N keys you make your way along the first level. Pressing Caps Shift enables you to jump over moving fire-balls and destroyed bridges to reach the life-saving lift.

After stepping on to the lift the next level must be cleared. Jane cannot be rescued if any of the bridges are left standing so, because of the fact that you cannot go down, all the bridges must be destroyed on the way up.

Figure 3.

In each game a player gets five lives, and a running score is kept throughout.

When entering the program type in the short routine in figure 1 and input the data from figure 2.

After doing this, New the program as the data has been placed above RAMtop. Now type in the main Basic program listing. Figure 3 will help with the user graphics. When the main program has been entered it must now be saved in the following way:

Type as a direct command

SAVE "LIFTER" LINE 9999

Press Enter and tape the program. When it has saved stop the tape immediately and type:

SAVE "USER DEF." CODE USR "a",128

Press Enter and save the data.

The two programs should now be verified, so rewind the tape to the beginning and type:

VERIFY "": VERIFY "" CODE

Press Enter and play on the tape.

If the program failed to verify save it again using the same procedure as before. Now New the program and reload it from the tape. Happy hunting!

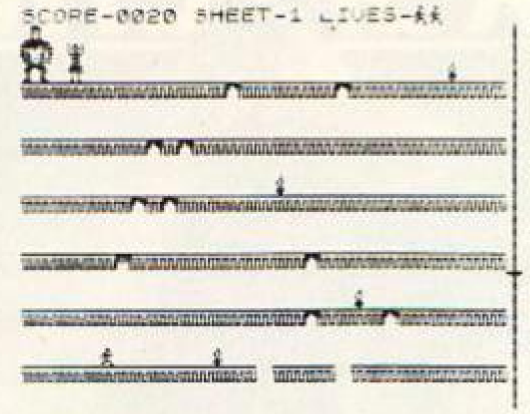

Figure 1.

```
 10 FOR n=USR "a" TO (USR "p"+7
)
 20 INPUT c: POKE n,c
 30 PRINT n,c
 40 NEXT n
```

Figure 2.

```
24 24 48 124 176 56 100 70
24 24 12 62 13 28 38 58
153 189 189 153 126 60 60 60
60 126 126 255 36 36 36 102
255 255 231 195 129 129 129 0
3 7 5 6 4 6 31 127
128 192 64 192 64 192 240 252
255 251 209 208 216 216 121 124
254 191 23 19 51 51 54 118
31 31 60 56 56 24 56 120
240 240 120 56 56 48 56 60
255 0 221 85 85 85 119 0
255 126 24 24 24 24 24 24
24 24 24 24 24 24 24 24
8 24 36 40 24 60 60 24
60 66 129 129 129 129 66 60
```

The Basic program.

```
 10 CLS : PRINT AT 5,5;"LIFTER
 © Colin Stewart": PRINT AT 8,12
;"N....LEFT";AT 10,12;"M...RIGHT
";AT 14,3;"CAPS SHIFT and N or M
...JUMP": PAUSE 500
 100 LET m=1: LET lift=20: LET d
f1=1: LET df2=0: LET df3=0: LET
df4=1: LET delay=20: LET sheet=0
: LET sc=0: LET lives=5: BORDER
0: PAPER 0: INK 7: CLS : GO SUB
9000
 110 LET a=18: LET b=2: PRINT AT
a,b;"*"
 120 IF INKEY$="M" OR INKEY$="N"
THEN GO SUB 500
 140 IF INKEY$="m" AND b<31 THEN
LET b=b+1: PRINT AT a,b-1;" *"
 150 IF INKEY$="n" AND b>1 THEN
LET b=b-1: PRINT AT a,b;"* "
 153 IF (a=3 AND b=f1+1) OR (a=9
AND b=f2+1) OR (a=15 AND b=f3+1
) OR (a=18 AND b=f4+1) THEN GO T
O 600
 155 IF ATTR (a+1,b)<>3 THEN GO
TO 400
 160 LET f1=f1+(df1=1)-(df1=0):
IF df1=0 AND f1<5 THEN LET df1=1
 161 IF df1=1 AND f1>26 THEN LET
df1=0
 165 PRINT AT 3,f1; INK 2;f$
 170 LET f2=f2+(df2=1)-(df2=0):
IF df2=0 AND f2<4 THEN LET df2=1
 171 IF df2=1 AND f2>23 THEN LET
df2=0
 175 PRINT AT 9,f2; INK 2;f$
 180 LET f3=f3-(df3=1)-(df3=0):
IF df3=0 AND f3<4 THEN LET df3=1
 184 IF df3=1 AND f3>25 THEN LET
df3=0
 185 PRINT AT 15,f3; INK 2;f$
 190 LET f4=f4+(df4=1)-(df4=0):
IF df4=0 AND f4<4 THEN LET df4=1
 191 IF df4=1 AND f4>22 THEN LET
df4=0
 195 PRINT AT 18,f4; INK 2;f$
 200 LET lift=lift-1: IF lift<1
THEN PRINT AT lift+1,31; INK 5;"
|": LET lift=20
 210 PRINT AT lift,31; INK 4;"T"
;AT lift+1,31; INK 5;"|"
 215 IF ATTR (a,b-1)=6 AND sc=(1
20*sheet) THEN PRINT AT a,b;" ":
 GO SUB 8000: GO SUB 9000: GO TO
 110
 220 GO TO 120
 400 IF ATTR (a+1,b)=5 THEN PRIN
T AT a+1,b;" ": LET sc=sc+(10 AN
D b<30): PRINT AT 0,6;"0000"( TO
 4-LEN STR$ sc);sc: GO TO 120
 410 IF ATTR (a+1,b)=7 THEN GO T
O 450
 420 IF ATTR (a+1,b)=4 THEN GO T
O 470
 450 FOR x=1 TO 2: PRINT AT a,b;
" ": LET a=a+(1 AND a<20): PRINT
 AT a,b;"*": IF ATTR (a+1,b)=3 T
HEN LET d$="|": GO TO 120
 452 NEXT x
 455 GO TO 700
 457 GO TO 120
 460 STOP
 470 LET a=a-1: LET b=31: LET li
ft=lift-1: PRINT AT a,b;"*";AT l
ift,b; INK 4;"T";AT lift+1,b; IN
K 5;"|": IF INKEY$="n" THEN GO T
O 490
 475 IF lift=1 THEN GO TO 600
 480 FOR x=1 TO delay: NEXT x: G
O TO 470
 490 PRINT AT a,b;"|": LET b=b-1
: GO TO 120
 500 IF INKEY$="M" THEN GO TO 52
0
 510 IF INKEY$="N" THEN GO TO 53
0
 515 RETURN
 520 PRINT AT a-1,b;"*";AT a,b;"
 ": LET b=b+1: PRINT AT a-1,b;"*
";AT a-1,b-1;" ": LET b=b+1: PRI
NT AT a-1,b;"*";AT a-1,b-1;" ";A
T a,b;"*";AT a-1,b;" ": RETURN
 530 PRINT AT a-1,b;"*";AT a,b;"
 ": LET b=b-1: PRINT AT a-1,b;"*
";AT a-1,b+1;" ": LET b=b-1: PRI
NT AT a-1,b;"*";AT a-1,b+1;" ";A
T a,b;"*";AT a-1,b;" ": RETURN
 600 FOR x=90 TO 65 STEP -1: PRI
NT AT a,b; OVER 1;CHR$ x: BEEP .
01,x-50: NEXT x: PRINT AT a,b;"
": GO TO 800
 700 FOR x=a TO 21: PRINT AT x,b
;"*";AT x-1,b;" ": BEEP .01,x: N
EXT x: FOR y=90 TO 65 STEP -1: P
RINT AT x-1,b; OVER 1;CHR$ y: BE
EP .01,y-50: NEXT y: PRINT AT x-
1,b;" "
 800 LET lives=lives-1: PRINT AT
0,25;"*****"( TO lives);" "
 805 BEEP .25,5: BEEP .25,2: BEE
P .1,7: BEEP .3,5: BEEP .3,2
 810 IF lives>0 THEN GO TO 110
 820 PRINT AT 19,10; INK 6; FLAS
H 1;"GAME OVER";AT 21,3; FLASH 0
; INK 4;"Press 'R' to play again
"
 830 IF INKEY$<>"r" THEN GO TO 8
30
 840 RUN
8000 RESTORE 8010: FOR x=1 TO 22
: READ b,a: BEEP a/30,b: NEXT x
8010 DATA 0,3,2,3,4,3,5,5,0,6,5,
3,4,3,5,3,7,5,2,6,5,3,4,3,5,3,2,
3,5,7,1,5,7,4,5,3,5,0,4,3,2,4,1,
4,5,5
8020 RETURN
9000 FOR x=3 TO 20 STEP 3: PRINT
 AT x,0;"
                  ": NEXT x
9005 FOR x=4 TO 20 STEP 3: PRINT
 AT x,0; INK 3;"
": NEXT x: FOR x=
3 TO 21: PRINT AT x,31; INK 5;"|
": NEXT x: PRINT AT 20,31; INK 4
;"T"
9007 FOR x=4 TO 20 STEP 3
9010 LET r=INT (RND*20)+5: LET t
=INT (RND*20)+5: IF r=t OR r+1=t
 OR r-1=t THEN GO TO 9010
9015 PRINT AT x,r; INK 5;"*";AT
x,t; INK 5;"*": NEXT x
9020 PRINT AT 18,2;"*"
9030 GO SUB 9100: LET f1=6: LET
f2=15: LET f3=8: LET f4=9: INK 2
: PRINT AT 3,f1;f$;AT 9,f2;f$;AT
 15,f3;f$;AT 18,f4;f$: INK 7
9040 PRINT AT 1,0; INK 6;"*";AT
 2,0;"**";AT 3,0;"**"
9060 LET sheet=sheet+1: LET dela
y=delay-1
9070 PRINT AT 0,0;"SCORE-";"0000
"( TO 4-LEN STR$ sc);sc;" SHEET-
";sheet;" LIVES-";"*****"( TO li
ves);" "
9080 RETURN
9100 IF m=1 THEN LET f$="*": L
ET m=m+1: RETURN
9110 IF m=2 THEN LET f$="O": L
ET m=m+1: RETURN
9120 IF m=3 THEN LET m=1: GO TO
9100
9999 LOAD ""CODE : RUN
```

3D Cubert 64

Lee Marsh,
Croydon,
Surrey.

CBM-64

THIS ARCADE-TYPE game for the Commodore 64 is based on the originally titled arcade game Q*BERT.

My version consists of a pyramid of 3D blocks which have to be turned yellow by moving your friend Cubert on to them. When all the blocks have been turned yellow you

(continued on page 177)

INCREASE YOUR COMPUTER FUN WITH A PROTEK JOYSTICK SET.

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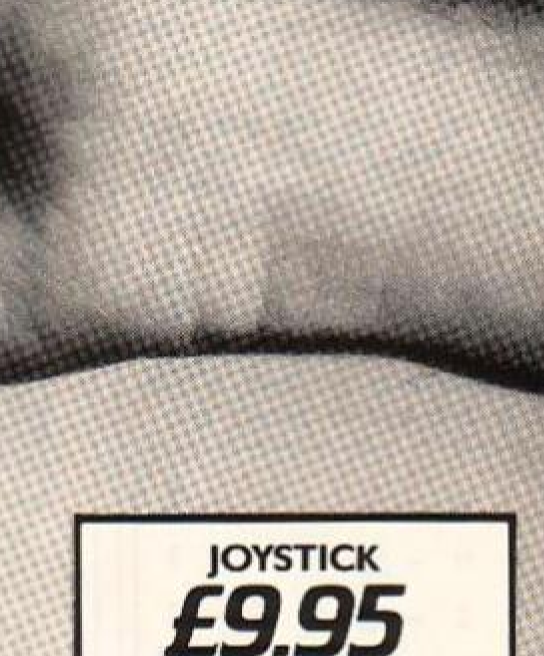

Protek

VISA

Protek Computing Ltd, 1A Young Square, Brucefield Industrial Park, Livingston, West Lothian. 0506 415353.

(continued from page 175)

have to make your way to the disc at the top of the pyramid. You will see Cubert being teleported up and off the screen. You will collect a bonus and enter the next level.

Obviously it is not as easy as that; the witch who caught Cubert in the first place has two evil helpers, the magical bouncing ball and the evil venomous spider. You must be careful when moving near them because if they touch you, you will die. You must also be careful when moving near the edge of the pyramid because one false move and you will cause Cubert to fall to his death, with a noisy departure.

The witch likes seeing Cubert die so she revives him three times, using her very powerful magic.

The program uses six sprites, one multicolour and there are also many user-defined characters — including the character set. There is a slight pause at the very beginning, before the opening sequence, while variables, graphics etc. are set up.

You can control movement by the keyboard or the joystick and there is a high-score table which keeps the top five scores and initials. Control is F1 — up; F7 — down; Z — left; C — right.

The program includes Rem statements which help to explain some fairly complicated sprite switching and collision detection routines.

Certain lines will need to be typed in, using abbreviations found on pages 130 and 131 of the user manual.

```
1 REM ********************************
2 REM ***3D CUBERT 64(C) BY L.MARSH***
3 REM *GRAPHICAL CONCEPTS BY D.SHEVEL*
4 REM ********************************
5 CLR:GOSUB50000:RESTORE:POKE53280,0:POKE53281,0:FORT=1TO5:HP$(T)="00000 ???"
6 NEXT:PRINT"[control characters]"
19 PRINT"[control characters]":POKE53272,(PEEK(53272)AND240)OR12:GOSUB1000
25 READC
26 IFC=-1THEN63000
27 FORD=0TO7
28 READA
29 POKE12288+(C*8)+D,A
30 NEXTD
35 GOTO25
50 REM **SET UP 3D CUBERT 64 SCREEN**
51 PRINT"[graphics]"
52 PRINT"[graphics]"
53 PRINT"[graphics]"
54 PRINT"[graphics]"
55 PRINT"[graphics]"
56 PRINT"[graphics]"
57 PRINT"[graphics]"
58 PRINT"[graphics]"
59 PRINT"[graphics]"
60 PRINT"[graphics]"
61 PRINT"[graphics]"
62 PRINT"[graphics]"
63 PRINT"[graphics]"
64 PRINT"[graphics]"
65 PRINT"[graphics]"
66 PRINT"[graphics]";
67 GOSUB5000
68 REM**SET POSITION OF SPINNING DISC**
69 POKEV,73:POKEV+1,92
70 REM**SET MULTICOLOUR 1 IN SPRITE 0**
71 POKE53285,2
72 REM**SET MULTICOLOUR 2 IN SPRITE 0**
73 POKE53286,1
74 REM********************************
75 REM****MAIN PART OF THE PROGRAM****
76 REM********************************
80 REM
81 SX=102:SY=150:BX=200:BY=133:SO=54272:X=48:Y=199:BO=1000+(10*LV):GOTO182
82 S$=STR$(SC):O=LEN(S$):S$=LEFT$("00000",6-O)+RIGHT$(S$,O-1)
83 PRINT"[control characters]"TAB(33)"[control characters]KOSWI[control characters]";S$
84 PRINT"[control characters]"TAB(32)"[control characters]MXOSWI[control characters]";LEFT$(HP$(1),5)
85 PRINT"[control characters]"TAB(33)"[control characters]PIZIP[control characters]";LV
86 PRINT"[control characters]"TAB(34)"[control characters]IF[control characters]";M
87 PRINT"[control characters]"TAB(33)"[control characters]SZIX[control characters]";MO
89 BO=BO-10:IFBO=<0THENBO=0
90 IFM=0THEN20000
91 JS=PEEK(56321):KB=PEEK(203)
92 IFJS=239THEN180
93 IFJS=247ORKB=20THENY=Y-16:X=X+24:D1=4:D2=5:M$="R":POKEV+21,29:GOTO180
94 IFJS=251ORKB=12THENY=Y-8:X=X-24:D1=2:D2=3:M$="L":POKEV+21,27:GOTO180
95 IFJS=254ORKB=4THENY=Y-24:X=X-8:M$="U":GOTO180
96 IFJS=253ORKB=3THENY=Y-8:X=X+8:M$="D":GOTO180
97 IFJS=255ORKB=64THEN180
100 GOTO90
180 REM**MAIN MOVE & CHECK ROUTINE**
181 POKEV+D1,X:POKEV+D2,Y
182 REM**MOVE SPIDER AND BALL**
184 BX=BX-24:BY=BY-16
186 IFSX>XTHENSX=SX-((2+(LV/2))):GOTO188
187 IFSX<XTHENSX=SX+((2+(LV/2)))
188 IFSY>YTHENSY=SY-((2+(LV/2))):GOTO190
189 IFSY<YTHENSY=SY+((2+(LV/2)))
190 POKEV+8,SX:POKEV+9,SY:POKEV+6,BX:POKEV+7,BY:BY=BY+24
192 GOSUB900:POKEV+D1,X:POKEV+D2,Y:POKEV+8,SX:POKEV+9,SY:POKEV+6,BX:POKEV+7,BY
193 IFBX=XAND(BY=>YANDBY=<Y+21)THEN61000
194 IFBX<=40THENBX=232:BY=125
195 VOL=54296:WFM=54276:ATT=54277:H=54273:LO=54272:POKEVOL,15:POKEWFM,33
196 POKEATT,15:POKEATT+1,255:POKEH,72:POKELO,169
206 P=((X-24)/8)+40*((Y-50)/8):POKEWFM,0:POKEATT,0
207 IFX=72ANDY=79ANDSO=33THEN62000
208 IFPEEK(1024+(P+96))=32THENGOSUB10000
209 IFPEEK(1024+(P+96))=20THEN300
215 SC=SC+50:SO=SO+1
221 POKE1024+(P+96),20:POKE1024+(P+97),20:POKE55296+(P+96),7:POKE55296+(P+97),7
300 REM**CHECK ROUTINE FOR COLLISIONS**
301 IFBX=XAND(BY=>YANDBY=<Y+21)THEN61000
302 IF((SY+10)=>(Y+5))AND((SY+10)=<(Y+16))ANDSX=>(X+4)ANDSX=<(X+20)THEN61000
303 IFSY=<(Y+16)ANDSY=>(Y+5)ANDSX=>(X+4)ANDSX=<(X+20)THEN61000
304 IF(SX+24)=>(X+4)AND(SX+24)=<(X+20)ANDSY=>(Y+5)ANDSY=<(Y+16)THEN61000
305 IFSX=<(X+20)ANDSX=>(X+4)ANDSY=>(Y+5)ANDSY=<(Y+16)THEN61000
400 GOTO82
900 IFM$=""THENRETURN
902 IFM$="R"THENMO=MO+1:M$="":V=V+8:RETURN
903 IFM$="L"THENMO=MO+1:M$="":V=V+16:RETURN
904 IFM$="U"THENMO=MO+1:M$="":V=V+0:RETURN
905 IFM$="D"THENMO=MO+1:M$="":V=V+24:RETURN
999 REM**SPRITE SET UP AND DATA**
1000 V=53248:POKEV+28,1
1005 POKEV+21,61:POKEV+27,0
1010 POKE2040,200:FORI=64*200TO64*200+62:READS:POKEI,S:NEXT:POKEV+39,1
1014 POKE2041,201:FORI=64*201TO64*201+62:READS:POKEI,S:NEXT:POKEV+40,5
1015 POKE2042,202:FORI=64*202TO64*202+62:READS:POKEI,S:NEXT:POKEV+41,5
1016 POKE2043,203:FORI=64*203TO64*203+62:READS:POKEI,S:NEXT:POKEV+42,8
1017 POKE2044,204:FORI=64*204TO64*204+62:READS:POKEI,S:NEXT:POKEV+43,4
1018 POKE2045,205:FORI=64*205TO64*205+62:READS:POKEI,S:NEXT:POKEV+44,9:RETURN
1019 REM ***DATA FOR SPRITE 0***
1020 DATA7,255,64,21,253,80,85,117,84,85,85,84,213,117,92,245,253,124,255,255
1021 DATA252,61,85,240,13,85,192,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0
1022 DATA0,0,0,0,0,0,0,0,0,0,0,0
1023 REM ***DATA FOR SPRITE 1***
1024 DATA0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,255,192,3,254,112,7,255,56,6,115,156,14
1025 DATA115,140,15,255,140,15,255,140,12,3,152,6,7,48,3,158,224,0,255,128,0,0,0
1026 DATA0,0,0,0,0,0,0,0,0,0,0,0
1027 REM ***DATA FOR SPRITE 2***
1028 DATA0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,3,255,0,14,127,192,28,255,224,57,206,96
1029 DATA49,206,112,49,255,240,49,255,240,25,192,48,12,224,96,7,121,192,1,255,0
1030 DATA0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0
1031 REM ***DATA FOR SPRITE 3***
1032 DATA0,252,0,3,227,0,7,227,128,7,241,128,7,241,128,7,227,128,3,227,0,0,252
1033 DATA0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0
1034 DATA0,0,0,0,0
1035 REM ***DATA FOR SPRITE 4***
1036 DATA0,62,0,0,127,0,3,201,224,14,73,56,24,255,140,25,182,204,27,54,108,25
1037 DATA140,204,13,128,216,0,193,128,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0
1038 DATA0,0,0,0,0,0,0,0,0,0,0,0,0,0
1040 REM ***DATA FOR SPRITE 5***
1041 DATA0,0,0,0,0,0,0,0,0,0,56,0,0,56,0,0,124,0,0,254,0,0,124,0,0,126,0,0,60
1042 DATA0,0,248,0,1,254,0,1,254,0,3,255,0,7,255,0,199,255,0,119,255,0,255,255
1043 DATA252,115,254,0,192,0,0,0,0,0
1999 REM ***HI RES CHARACTERS***
2000 DATA32,0,0,0,0,0,0,0,0
2001 DATA0,255,255,255,255,255,255,255,255
2002 DATA1,1,3,7,15,31,63,127,255
2003 DATA2,255,127,63,31,15,7,3,1
2004 DATA3,128,192,224,240,248,252,254,255
2005 DATA4,255,254,252,248,240,224,192,128
2006 DATA20,255,255,255,255,255,255,255,255
2007 DATA5,60,126,102,102,126,126,102,102
2008 DATA6,124,102,102,124,124,102,102,124
2009 DATA7,60,126,102,96,96,102,126,60
2010 DATA8,120,124,110,102,102,110,124,120
2011 DATA9,126,126,96,124,124,96,126,126
2012 DATA10,126,126,96,124,124,96,96,96
2013 DATA11,60,126,102,96,110,102,126,60
2014 DATA12,102,102,102,126,126,102,102,102
2015 DATA13,126,126,24,24,24,24,126,126
2016 DATA14,62,62,12,12,12,108,108,56
2017 DATA15,102,110,124,120,120,124,110,102
2018 DATA16,96,96,96,96,96,96,126,126
2019 DATA17,99,99,119,127,107,99,99,99
2020 DATA18,102,110,126,126,126,110,102,102
2021 DATA19,60,126,102,102,102,102,126,60
2022 DATA21,124,126,102,102,126,124,96,96
2023 DATA22,60,126,102,102,102,110,126,62
2024 DATA23,124,126,102,102,124,124,102,102
2025 DATA24,60,102,96,124,62,6,102,60
2026 DATA25,126,126,24,24,24,24,24,24
2027 DATA26,102,102,102,102,102,102,126,60
2028 DATA27,102,102,102,102,102,102,60,24
2029 DATA28,99,99,99,107,127,127,119,99
2030 DATA29,102,102,60,24,24,60,102,102
2031 DATA30,102,102,102,126,60,24,24,24
2032 DATA31,126,126,14,28,56,112,126,126
2033 DATA48,60,126,102,102,102,102,126,60
2034 DATA49,24,56,120,24,24,24,126,126
2035 DATA50,60,126,110,28,56,112,126,126
2036 DATA51,60,126,102,28,28,102,126,60
2037 DATA52,14,30,62,102,127,127,6,6
2038 DATA53,126,126,112,126,14,102,126,60
2039 DATA54,60,126,102,124,110,102,126,60
2040 DATA55,126,126,102,12,24,24,24,24
2041 DATA56,60,126,102,60,60,102,126,60
2042 DATA57,60,126,102,126,62,102,126,60
2043 DATA33,102,102,195,195,102,102,195,195
2045 DATA-1
5000 PRINT"[control characters]"SPC(31)"[graphics]";
5001 PRINT"[graphics]";
5005 RETURN
10000 REM**DEATH ROUTINE**
10001 POKEV+D1,X:POKEV+D2,Y
10002 IFKB=3THENPOKEV+27,1:GOTO10005
10003 IFJS=253THENPOKEV+27,1:GOTO10005
10004 POKEV+27,6
10005 VOL=54296:WFM=54276:ATT=54277:H=54273:LO=54272:POKEVOL,15:POKEWFM,33
10006 POKEATT,15
10007 FORT=YTO229:POKEV+D2,T:POKEH,T-34:POKELO,T-75:NEXT
10010 FORX=15TO0STEP-.5:POKEVOL,X:POKEWFM,129:POKEATT,15:POKEH,40:POKELO,200:NEX
T
10020 POKEWFM,0:POKEATT,0
10030 M=M-1:FORT=1TO1000:NEXT:IFM=0THEN82
10040 POKEV+27,0:D1=4:D2=5:POKEV+21,29:GOTO68
20000 POKEV+21,0:PRINT"[control characters]";:J=2
20001 FORT=1TO24:POKE646,J:PRINTTAB(14)"KEOI SZIW":J=J+1:IFJ=8THENJ=2
20002 FORTL=1TO10:NEXTTL:NEXT:FORT=1TO24:PRINT:FORTL=1TO20
20003 NEXT:NEXT:PRINT"[control characters]";:POKE198,0:POKE53272,(PEEK(53272)AND240)OR4
20004 K=0:FORI=1TO5:IFSC>VAL(LEFT$(HP$(I),6))THENK=I:I=5
20005 NEXT:IFK=0THENFORT=1TO1000:NEXT:GOTO20030
20006 POKE198,0:PRINTTAB(2)"[control characters]YOU ARE ONE OF THE TOP FIVE PLAYERS"
20007 PRINT"[control characters]ENTER YOUR INITIALS[control characters] ";:INPUTI$:IFLEN(I$)>3THEN20050
20008 FORI=4TOKSTEP-1:HP$(I+1)=HP$(I):NEXT
20010 S$=STR$(SC):O=LEN(S$):S$=LEFT$("00000",6-O)+RIGHT$(S$,O-1):HP$(K)=S$+" "+I
$
20030 REM **TOP SCORE**
20031 PRINT"[graphics]";
20032 PRINT"[graphics]3D-DIMENSION CUBERT[graphics]";
20033 PRINT"[graphics]"
20034 PRINTTAB(13)"[control characters]HALL OF FAME":PRINT"[control characters]          RANK SCORE NAME"
20035 FORI=1TO5:PRINT"[control characters]          "I"[control characters] "HP$(I):NEXT
20040 PRINT"[control characters]PLAY AGAIN[control characters](Y/N) ";:INPUTA$
20041 IFA$<>"Y"THENPOKE53280,14:POKE53281,6:PRINT"[control characters]";:END
20044 POKEV+21,61:POKEV+27,0:SO=1:MO=1
20045 POKE53272,(PEEK(53272)AND240)OR12:D1=4:D2=5:M$="":M=3:Z=0:LV=1:SC=0:GOTO50
20050 PRINT"[control characters]TOO LONG":FORT=1TO400:NEXT:GOTO20006
50000 POKE53280,0:POKE53281,0
50106 V=53248:X=48:Y=199:SC=0:LV=1:TI$="000000":BO=500:D1=4:D2=5:M=3
50107 M$="":Z=0:MO=1:SO=1
50110 PRINTCHR$(142):RETURN
61000 POKEWFM,33:POKEATT,15:FORT=75TO229:POKEH,T-34:POKELO,T-75:NEXT:GOTO10020
62000 REM*TELEPORT CUBERT TO NEXT LEVEL*
62001 PRINT"[control characters]":FORT=1TO7:PRINTTAB(5)"[control characters]":NEXT
62010 FORT=92TO40STEP-3
62015 FORTL=1TO40:NEXTTL
62016 POKE53285,2:POKE53286,1
62020 POKEV,73:POKEV+1,T:POKEV+D1,73:POKEV+D2,T-16
62025 FORTL=1TO60:NEXT
62030 POKE53285,1:POKE53286,2
62040 NEXTT
62041 PRINT"[control characters]";:FORT=1TO7:PRINTTAB(5)"[control characters] ":NEXT
62050 LV=LV+1
62051 Z$="[control characters]":X$="£IPP HSPI OZFI LSUUIW IRYIW PI[IP":A=1:B=1
62052 FORTL=1TO33:PRINT"[control characters]"LEFT$(Z$,A)RIGHT$(X$,B);LV:A=A+1:B=B+1
62053 IFA=12THENA=1
62054 FORT=1TO10:NEXTT:NEXTTL
```

(continued on page 179)

(continued from page 177)

```
62066 T=200
62068 FORTT=1TO20
62070 POKE54296,31
62071 POKE54277,200
62072 POKE54278,190
62073 POKE54273,10+T:POKE54272,255-T
62074 POKE54293,55:POKE54294,255:POKE54295,22:POKE54275,11:POKE54274,76
62075 POKE54276,65
62077 T=T-10:IFT<=0THENT=100
62078 NEXTTT:POKE54276,0
62080 A=1:B=33:FORTL=1TO33:PRINT"@"LEFT$(Z$,A)RIGHT$(X$,B):LV."■ ":A=A+1:B=B-1
62081 IFA=12THENA=1
62082 FORT=1TO10:NEXTT:NEXT:PRINT"■     ■■SZ LEZI KEMRIH■";BO;"■FSRZX USMPVX"
62083 FORTL=1TO750:NEXTTL:PRINT"■                                           ■";
62085 SC=SC+BO:MO=1:SO=1:GOTO50
63000 PRINT"■■";
63005 FORT=0TO235STEP2:POKEV+10,T:POKEV-11,128
63006 IFT=100THENPRINT"■■■■■■■■■■■■"TAB(16)"■WIEH!"
63010 POKEV+4,T+20:POKEV+5,132:NEXT
63015 POKEV+16,255:FORT=0TO85STEP2:POKEV+10,T:POKEV+11,128:POKEV+4,T+20
63020 POKEV+5,132:NEXT:POKEV+10,0:POKEV+4,0:POKEV+16,0
63025 GOTO50

READY.
```

Stuka

Kevin Bramhill,
Binbrook,
Lincoln.

BBC

THE GAME IS called Stuka and is for the BBC Micro Model B or A with 32K. The object is to destroy the stukas and their bombs before they blow up all your towns. Their are nine levels, one of which you must select to begin play. The level of play you select controls the size of the flack, the size of towns, the amount of a town which burns up with each bomb that hits it and the time before the stukas begin to drop bombs.

A separate high score is kept for each level. The level you have selected appears below your anti-aircraft gun.

If your gun keeps getting blown up, press "Fire" and "Detonate" — Z and X — together and try to get the bombs in the flack clouds.

```
10*TV255
20REM STUKA' BY K.BRAMHILL
30SCR=0:*FX4,1
40*FX16,0
50DIMHS%(1,9,3),HS%(8):ON ERROR GOTO1260
60FORA=0TO8:HS%(A)=0:NEXT
70L=1200:W=50:M=100:q%=900:xx%=1279:yy%=1023:SCR=0:
RL=0:*FX10,3
80G=0:MODE7
90PRINTTAB(14,2)CHR$129CHR$141"STUKA !"'TAB(14,3)CH
R$131CHR$141"STUKA !":SOUND16,2,70,25
100PRINT'TAB(4)CHR$130"SHOOT DOWN THE STUKA DIVE-BOM
BERS"'CHR$130"BEFORE THEY DESTROY ALL YOUR TOWNS OR"'C
HR$130"YOUR ANTI-AIRCRAFT GUN."
110ENVELOPE1,1,0,0,0,-1,-1,-1,127,1,-1,-10,120,120
120ENVELOPE2,5,0,0,0,-1,-1,-1,127,1,-1,-10,120,120
130ENVELOPE3,1,65,43,85,18,30,11,75,20,-3,45,31,131
140PRINT'TAB(14)CHR$133"CONTROL:-":FO%=0:PH%=0
150PRINT'TAB(5)CHR$133"< LOWER ANTI-AIRCRAFT GUN"'TA
B(5)CHR$133">  RAISE ANTI-AIRCRAFT GUN"'TAB(5)CHR$133"Z
  FIRE ANTI-AIRCRAFT GUN"'TAB(5)CHR$133"X"SPC(8)CHR$13
3"DETONATE  SHELL."
160PRINT'CHR$131"  PRESS ESCAPE TO TERMINATE A GAME.
"
170PRINT'CHR$134"STUKAS SCORE 100:WRECKAGE 50:BOMBS
250"
180IFSCR PRINTTAB(7,22)CHR$134"LEVEL ";LS%+1;TAB(16,
22)";LAST SCORE ";SCR
190PRINTTAB(7,24)CHR$134"PRESS KEY (1-9,9=HARD) TO B
EGIN."TAB(0,0)
200VDU23;8202;0,0,0;PRINT" "
210A$=INKEY$(M):IFA$<>"" SOUND17,3,ASCA$,9:IFVAL(A$)
=0THEN210ELSEL%=VAL(A$):LS%=L%-1:BI%=(INT(L%/2)*16)+24
220IFA$=""THENPRINTTAB(7,20)CHR$134"LEVEL ";RL+1;TAB
(16,20)";HIGH SCORE"SPC(6)TAB(28,20)HS%(RL):RL=RL+1:IF
RL=9THENRL=0
230IFA$=""THEN210
240MODE2:GCOL0,2:MOVE0,W:PLOT85,xx%,0:XP=0:MOVExx%,W
:PLOT85,0,W:COLOUR17:PRINTTAB(4,15)"...HOLD ON..."TAB(
0,0);:*FX15,0
250GOSUB1250:MOVEq%,W:MOVEL,W:PLOT85,L,M:PLOT85,xx%,
W:PLOT85,xx%,M
260VDU5:GCOL0,8:GCOL0,130:MOVE1210,46:PRINTSTR$(L%):
VDU4
270GCOL0,4
280FORA=0TO2:FORB=0TO20-L%:MOVE300*A+M+B*8,W:DRAW300
*A+M+B*8,59+RND(39)
290NEXT:NEXT:CB%=63-3*L%
300GCOL0,5:MOVEL+W,M:E%=30:DRAWxx%,130:MOVExx%,M:DRA
Wxx%-E%,180-E%
310BX%=0:TD%=(9-L%)*q%
320VDU23;8202;0,0,0;PRINTTAB(0,0);:COLOUR141:COLOUR8
:PRINTSPC(20)
330SCR=0:BV%=0:PY%=0:PU%=0:BC%=0:BN%=0:BZ%=0:PX%=0:C
R=0
340FORB=0TO3:FORA=0TO9
350BS%(0,A,B)=(40-2*L%)-(4*RND(20-L%))
360BS%(1,A,B)=(40-2*L%)-(4*RND(20-L%))
370NEXT:NEXT:PROCH:VDU19,8,6;0;19,6,3;0;19,5,6;0;19,
13,4;0;
380G=1:PROCK:TIME=0
390PROCA:PROCG:PROCU
400GCOL0,0:MOVE1,RND(890)+M:DRAWxx%,RND(840)+150:DRA
W500,RND(890)+M
410PROCB:PROCA:PROCG:PROCS
420IFCB%<1COLOUR12:COLOUR128:PRINTTAB(8,8)"GAME"TAB(
8,9)"OVER":VDU19,4,9;0;:GOTO170
430PROCG:GOTO390
440DEFPROCG
450IFINKEY(-104)=0ANDINKEY(-103)=0ENDPROC
460GCOL0,0:MOVExx%,M:DRAWxx%-E%,180-E%
470IFINKEY(-104)=-1ANDE%>10 E%=E%-2
480IFINKEY(-103)=-1ANDE%<76 E%=E%+2
490GCOL0,5:MOVExx%,M:DRAWxx%-E%,180-E%:MOVE1250,M:DR
AWxx%,130:ENDPROC
500DEFPROCA
510IFXP THEN610
520IFSX=0ANDINKEY(-98)=-1SS%=(10-(E%/8))*4:SX%=xx%-(E
%+1.5*(E%-10)):SY%=180+(1.5*(E%-10)-E%):L%=6*(E%/8):
SOUND16,1,70,9
530GCOL0,0:IFSS%=0ENDPROC ELSEPLOT69,SX%,SY%:SX%=SX%-
L%:SY%=SY%+SS%
540IFSX%<0ORSY%>yy%SS%=0
550GCOL0,7
560IFSS%PLOT69,SX%,SY%
570IFINKEY(-67)=-1SS%=0:SOUND16,1,94,15:GOTO590
580ENDPROC
590GCOL0,3:XP=1:x%=RND(4)-1
600FORA%=0TO9:MOVESX%,SY%:DRAWSX%+S%(0,A%,x%),SY%+S%
(1,A%,x%):NEXT:PROCD:ENDPROC
610GCOL0,7:FORA%=0TO9:MOVESX%,SY%:DRAWSX%-S%(0,A%,x%
),SY%-S%(1,A%,x%):NEXT:XP=0:ENDPROC
620DEFPROCS
630IFPH%THEN770
640IFPO%THEN680
650IFRND(2)=1PO%=115:SS%=250 ELSEENDPROC
660PX%=RND(400):PY%=yy%:PU%=1:IFRND(2)=1PX%=xx%-PX%
670PV%=RND(30):PD%=RND(25):IFPX%>640PV%=-PV%:SN=5
680GCOL0,0:PLOT69,PX%,PY%
690PX%=PX%+PV%:PY%=PY%-(PU%*INT(SQR(PO%/1.0))):PO%=
PO%-PU%:IFPY%<260PU%=-1
700PROCD
710GCOL0,7:PLOT69,PX%,PY%
720IFPX%<0ORPX%>xx%PO%=0
730IFPY%>1023PO%=0
740SS%=SS%+PU%
750SOUND18,-10+PY%/200,SS%,9
760ENDPROC
770PX%=PX%+FS:PY%=PY%-PA:PA=PA+.2:IFPX%<0 ORPX%>xx%
THEN820
780IFFS>0FS=FS-.02ELSE FS=FS+.02
790A=POINT(PX%,PY%):GCOL0,7:MOVEPX%-FS,PY%+PA:DRAWPX
%,PY%
800IF(A)1ANDA<7)ORRND(q%)=1ORPY%<W GOTO820
810SS%=SS%+1:SOUND17,-10,SS%+M,9:ENDPROC
820SOUND16,2,246,9:IFA=2GCOL0,0:PLOT69,PX%,PY%ELSEIF
A=4THENCB%=CB%-1:MOVEPX%,W:GCOL0,9:DRAWPX%,99 ELSEIFA=
3THENCR=W:PROCH ELSEIFA=3THENCR=W:PX%=0:PY%=0:PO%=0:PH
%=0:PROCH
830PV%=0:IF(PX%>1250ORPX%>xx%-E%)AND(PY%<130ORPY%<18
0-E%)BX%=PX%:BY%=PY%:GOTO1120
840ENDPROC
850DEFPROCB
860IFBV%THEN910
870IFBZ%THEN1040
880IFTIME<TD%THENENDPROCELSEIF(POINT(PX%,W)=4ORPX%>1250)
ANDPU%>0ANDPO%>0THENBV%=PU%*INT(SQR(PY%/1.0)):BD%=PV%
/2:BX%=PX%:BY%=PY%:GOTO900ELSEENDPROC
890IFPY%<750-TD%ANDPO%>0ANDPU%>0ANDRND(25)=1BV%=PU%*
INT(SQR(PO%/1.0)):BD%=PV%/2:BX%=PX%:BY%=PY%
900BS%=25:ENDPROC
910A=POINT(BX%,BY%):IFA=3THEN990
920GCOL0,0:PLOT69,BX%,BY%:BX%=BX%+BD%:BD%=BD%/2:BY%=
BY%-BV%:BV%=BV%+1:IFBY%<W BY%=W
930A=POINT(BX%,BY%):IF(A>1ANDA<5)ORA=9VDU19,0,7;0;:G
OTO990
940IFA=5THEN1120
950GCOL0,6:PLOT69,BX%,BY%
960BS%=BS%-1:SOUND19,-7,BS%+79,9
970IFBY%<51BV%=0:GCOL0,0:PLOT69,BX%,BY%:GOTO1000
980ENDPROC
990GCOL0,0:MOVE1,RND(894)+M:DRAWxx%,RND(814)+180:IFA
=2THENGCOL0,0:PLOT69,BX%,BY%
1000SOUND16,2,14,20
1010BV%=0:VDU19,0,0;0;:IFA=3CR=250:PROCH:ENDPROC
1020IFA<>2THEN1040
1030ENDPROC
1040GCOL0,9:BY%=W:BZ%=1:KC%=0:KK%=0
1050IFPOINT(BX%-BC%,BY%)=4CB%=CB%-1:IFCB%=9VDU19,4,3;
0;
1060IFPOINT(BX%-BC%,BY%+BN%)=4PLOT69,BX%-BC%,BY%+BN%
1070IFPOINT(BX%+BC%,BY%)=4CB%=CB%-1:IFCB%=9VDU19,4,3;
0;
1080IFPOINT(BX%+BC%,BY%+BN%)=4PLOT69,BX%+BC%,BY%+BN%
1090BN%=BN%+4:IFBN%=56BN%=0:BC%=BC%+8:IFPOINT(BX%-BC%
,BY%)<>4ANDPOINT(BX%+BC%,BY%)<>4BC%=0:BZ%=0ELSEIFBC%=B
I%BC%=0:BZ%=0
1100IFKC%=1ANDKK%=1BC%=0:BZ%=0
1110ENDPROC
1120SOUND16,1,0,M
1130FORA=0TO55:SOUND16,2,4,M:GCOL0,7
1140MOVEBX%,BY%:DRAWRND(xx%),RND(yy%):GCOL0,0:DRAWBX%
,BY%
1150NEXT:CB%=0
1160ENDPROC
1170SOUND17,1,5,W:GOSUB1240:SOUND18,1,5,W:GOSUB1240:S
OUND19,1,10,W:GOSUB1240:SOUND1,1,5,W:GOSUB1240:SOUND2,
1,5,W:GOSUB1240:SOUND3,1,10,W:GOSUB1240
1180SOUND1,2,20,254:GOSUB1240:SOUND2,2,30,254:GOSUB12
40:SOUND3,2,0,254:GOSUB1240:GOSUB1240:SOUND16,2,70,M
1190FORA=0TOM:B=M+(300*(RND(3)-1))+RND(160):C=RND(40)
+W:MOVEB,C:GCOL0,RND(7):DRAWRND(xx%),RND(q%)+M:GCOL0,0
:DRAWB,C:NEXT
1200*FX15,1
1210GOSUB1250:GOSUB1250:GOSUB1250:GOSUB1250
1220IFSCR>HS%(LS%)THENHS%(LS%)=SCR
1230GOTO80
1240TIME=0:REPEATUNTILTIME=40:RETURN
1250A=RND(M):SOUND1,2,A,M:SOUND2,2,A+1,M:SOUND3,2,A,M
:RETURN
1260IFG=1THEN1220ELSEGOTO80
1270DEFPROCH
1280SCR=SCR+CR:PRINTTAB(0,0)"SCORE":PRINTTAB(6,0);SCR
:PRINTTAB(12,0)"HI":PRINTTAB(15,0);HS%(LS%);:ENDPROC
1290DEFPROCK:*FX15,1
1300SOUND17,2,W,W:SOUND18,2,W,59:SOUND19,2,51,59:COLO
UR128:COLOUR12:PRINTTAB(0,15)"PRESS A KEY TO BEGIN":A=
GET
1310COLOUR0:PRINTTAB(0,15)"PRESS A KEY TO BEGIN":COLO
UR141:COLOUR8:SOUND17,1,2,W:SOUND18,1,3,W:SOUND16,2,3,
W
1320ENDPROC
1330DEFPROCU
1340IFPH%THENENDPROC
1350IFPOINT(PX%,PY%)=3PO%=0:PH%=1:CR=M:PA=PU%*5:FS=PV
%:SOUND16,2,5,55:SS%=250:PROCH
1360ENDPROC
>
```

Footballer

Dirk Lampe,
Renhold,
Bedford.

VIC-20

THIS PROGRAM SIMULATES one of the first-ever slot-machines arcade games namely that of football in which a ball bounces around a court on the screen, and two players armed with a bat try to protect their own goal, and at the same time try to score goals against their opponent.

This particular version was written on a Vic-20 in Commodore Basic and occupies about 2,450 bytes on this machine. On adding 8K or more memory to a Vic-20, the screen memory is relocated, and this program takes note of this. As such this program can be run as written on any Vic.

The game may be played either by two

(continued on next page)

```
10 SS=PEEK(648)*256:CL=30720:IFSS=4096THENCL=33792
20 POKE650,128
30 POKE788,194:POKE37150,3
90 POKE36879,29
100 PRINT"■■                           FOOTBALL                    "
101 PRINT"WRITTEN BY ■DJA LAMPE■"
110 PRINT:INPUT"LEVEL";LE
120 PRINT"VERSUS VIC(Y/N)?"
130 GETA$:IFA$<>"Y"ANDA$<>"N"THEN130
140 IFA$="Y"THENV$="Y"
150 INPUT"PLAYER 1-NAME";N$
160 IFV$<>"Y"THENINPUT"PLAYER 2-NAME";O$
190 POKE36879,122
200 PRINT"■■■                                  0              0        "
;
201 IFV$="Y"THENPRINT"■■■■■■■■■■■■■VIC 20        "
202 PRINT"■■"N$:IFV$<>"Y"THENPRINT"■■■■■■■■■■■■■"O$
203 PRINT"■■■■■■■■■■■■■■■■■■■■■■■■■";
204 DD=0
205 PRINT"■                                      ";
210 FORI=1TO17:PRINT"■■                    ■";:NEXT
220 PRINT"■                                      ";
230 POKESS+505,160:POKESS+505+CL,2:PRINT"■■■■■■■■■■■■■■■■■■■■■■"
235 PRINT"■■■■■■■■■■■■■■■■■■■■■■"
240 S=0:SC=0
250 PO=SS+10+11*22:DI=-23:A=PO-7:B=PO+8:FORI=A-22TOA+22STEP22:POKEI,102:NEXT
255 FORI=B-22TOB+22STEP22:POKEI,102:NEXT
260 POKEPO,81
270 IFPEEK(PO+SGN(DI)*22)=32ANDPEEK(PO+DI)=32THENPOKEPO,32:PO=PO+DI:POKEPO,81:GO
TO600
```

(listing continued on next page)

(continued from previous page)

people, or by one against the computer. A joystick may also be used. Level 0 is the hardest. Higher levels are easier.

The program itself is relatively simple, but uses several memory-saving routines, and demonstrates how simple games can be written in Basic, and also makes some use of several interesting memory locations in the Vic.

Variables.

- SS Memory address at which the screen memory starts.
- CL Memory address at which the screen colour memory starts.
- N$ Name of player 1.
- O$ Name of player 2.
- V$ = Y if the player is playing against the computer, else N.
- A$ General purpose variable.
- DD Counter
- S Player 1 score.
- SC Player 2 score.
- A Position of player one's bat — Centre.
- B Position of player two's bat — Centre.
- DI The direction in which the ball is moving: up = 22, up + left = − 23, up + right = − 21, right = 1, left = − 1, down = 22, down + left = 21, down + right = + 23
- PO Position of the ball.
- I General purpose variable.
- B$ General purpose variable.

Address 650: If zero, then no keys repeat. If 128 then all repeat.

Address 648: The page on which the screen memory is located.

Address 197: code for key held down

Keys used to play

- A Player 1 base up.
- Z Player 1 base down.
- F1 Player 2 base up.
- F3 Player 2 base down.
- E To quit the game and start a new one. Player 1 may also use a joystick.

(listing continued from previous page)

```
271 IFPEEK(PO+DI)=102ANDPEEK(PO+DI-SGN(DI)*22)=32THENDI=-DI:GOSUB3010:GOTO600
272 IFPEEK(PO+SGN(DI)*22)=102THENGOSUB2000:GOTO600
274 IFPEEK(PO+DI)=32THENPOKEPO,32:PO=PO+DI:POKEPO,81:GOTO600
280 IFPEEK(PO-1)=86THENSC=SC+1:GOSUB1000:POKEPO,32:GOTO250
290 IFPEEK(PO+1)=86THENS=S+1:GOSUB1000:POKEPO,32:GOTO250
390 IFPEEK(PO+DI)=160THENGOSUB2000:GOTO600
400 GOSUB3000
600 GETA$:GOSUB4000:IFV$="Y"THENGOSUB5000
605 IFDD>650THEN7000
610 DD=DD+1:GOTO270
998 PRINT"■"
999 GOTO999
1000 PRINT"■■■■■■■"S:PRINT"■■■"SPC(18-LEN(STR$(SC)))"■"SC;
1010 POKE36878,15:FORI=128TO250:POKE36874,I:POKE36875,I:POKE36879,I:NEXT:POKE368
79,122
1020 POKE36874,0:POKE36875,0
1030 FORI=A-22TOA+22STEP22:POKEI,32:NEXT:FORI=B-22TOB+22STEP22:POKEI,32:NEXT:RET
URN
2000 DI=-(((DI=-21)*23)+((DI=-23)*21)+((DI=21)*-23)+((DI=23)*-21))
2010 POKE36878,15:POKE36877,240:FORI=1TO10:NEXT:POKE36877,0:RETURN
3000 DI=-(((DI=-21)*-23)+((DI=-23)*-21)+((DI=23)*21)+((DI=21)*23))
3010 POKE36878,15:POKE36877,230:FORI=1TO10:NEXT:POKE36877,0:RETURN
4000 GOSUB8000
4001 IFB$="A"THENGOSUB4020
4002 IFB$="Z"THENGOSUB4040
4004 IFA$="■"THEN4060
4006 IFA$="■"THEN4080
4007 IFA$="E"THENRUN
4008 RETURN
4020 IFPEEK(A-44)<>32THENRETURN
4025 POKEA+22,32:A=A-22:POKEA-22,102:RETURN
4040 IFPEEK(A+44)<>32THENRETURN
4045 POKEA-22,32:A=A+22:POKEA+22,102:RETURN
4060 IFPEEK(B-44)<>32THENRETURN
4065 POKEB+22,32:B=B-22:POKEB-22,102:RETURN
4080 IFPEEK(B+44)<>32THENRETURN
4085 POKEB-22,32:B=B+22:POKEB+22,102:RETURN
5000 IFPO<BANDPEEK(B-44)=32ANDRND(1)>LE/100THEN5030
5010 IFPO>BANDPEEK(B+44)=32ANDRND(1)>LE/100THEN5070
5020 RETURN
5030 POKEB+22,32:B=B-22:POKEB-22,102:RETURN
5070 POKEB-22,32:B=B+22:POKEB+22,102:RETURN
6000 B$="":IF(PEEK(37137)AND4)=0THENB$="A":RETURN
6010 IF(PEEK(37137)AND8)=0THENB$="Z":RETURN
6020 RETURN
7000 GOSUB1010:POKEPO,32:FORI=1TO5
7010 PRINT"■■■■■■■■■■■■■■■GAME OVER"
7015 FORJ=1TO1000:NEXT
7020 PRINT"■■■■■■■■■■■■■■■         "
7025 FORJ=1TO1000:NEXT
7030 NEXT
7040 RUN
8000 GOSUB6000:IFB$<>""THENRETURN
8010 B$="":C=PEEK(197):IFC=17THENB$="A":RETURN
8020 IFC=33THENB$="Z":RETURN
8030 RETURN
```

Tunnel Run

Michael Severs, Walton-on-Thames, Surrey.

DRAGON

THIS IS A GAME called Tunnel Run for the Dragon home micro. To play it you will need one joystick which should be plugged into the right-hand port. The object of the game is to escape from the planet Zoron on which you are held captive by the Zoronians. The only escape route is through a tunnel which is heavily guarded. You are armed with a laser cannon which can destroy the Zoronian bases and their missiles for 20 points each. The Zoronian bases are placed at random along the tunnel which has four different stages as follows:

A straight forward tunnel with Zoronians firing from bases on the bottom;

Pillars with Zoronian bases sometimes at the foot of them and sometimes at the top; a high wall which gets very difficult at points; a thin tunnel which weaves up and down, this does not have any Zoronians in it.

If you should manage to complete all four stages you will be awarded with a bonus of 500 points and on your first run an extra ship. You are blown up if you run into anything or a missile hits you. After losing a ship you start again at the beginning of the stage you were blown up in.

The program is mainly in Basic but does use six machine-code routines to speed things up, these are as follows:

Scroll screen one place; check ship position is clear; move Zoronian missiles up one space; fire Zoronian missiles; fire laser cannon; erase laser.

These are loaded into memory at the start of the game from Data statements.

At the end of each game your score is checked against the high score list to see if an entry should be made, if so then you are asked to enter your name. A high score list is shown and a demonstration of the first stage unless a button is pressed for a new game — the button can be on the keyboard or on the joystick.

When entering the game, remember to type the @ character instead of £.

```
1 '****************************
2 '**       tunnel run       **
3 '**                        **
4 '** (C) MICHAEL SEVERS '83 **
5 '****************************
10 CLEAR 500,31099
20 HI=0
30 GOSUB2070
40 GOSUB 1770
50 CLS0
60 SC=0:GOSUB 1740
70 LI=3
80 PLAY"O2T8L4CP4L4CCCP4CCCL4D-GD+CECD-GD+CEL4CP4CCCP4
CCCP4CCCP4CCL1CO3"
90 ST=1
100 TT=0
110 VE=0
120 H1=3:H2=5
130 POKE 32303,26
140 M1=5:M2=5
150 I1=1:I2=1
160 DI=.9
170 POKE 32095,0
180 S=256:S1=5
190 SH$=CHR$(233)+CHR$(227)+CHR$(239)+CHR$(227)
200 GOTO 1330
210 'move ship
220 S1=6
230 A=JOYSTK(0)
240 B=32303
250 C=PEEK(B)
260 IF A>60 AND C>13 THEN POKE B,C-1:S=S+1 ELSE IF A<3
 AND C<26 THEN POKE B,C+1:S=S-1
270 A=JOYSTK(1)
280 IF A>55 THEN S=S+32 ELSE IF A<5 AND S>63 THEN S=S-
32
290 RETURN
300 'move land
310 H1=H1+RND(2)-RND(2)
320 IF H1>M1 THEN H1=M1 ELSE IF H1<I1 THEN H1=I1
330 H2=H2+RND(2)-RND(2)
340 IF H2>M2 THEN H2=M2 ELSE IF H2<I2 THEN H2=I2
350 POKE 32096,H1:POKE 32097,H2
360 RETURN
370 'clean up and check if shot hit
380 EXEC 32450
390 IF PEEK(32095)=128 THEN PLAY"O1CDEDO3":SC=SC+20 EL
SE RETURN
400 IF SC>HI THEN HI=SC
410 PRINT@0,"";:PRINTUSING"CCCCC       TUNNEL RUN
CCCCC";SC;HI;
420 RETURN
430 'print enemy and bomb and move bombs
440 IF RND(0)>DI THEN EXEC 32100
450 IF RND(0)>DI THEN PRINT@511-32*H1,CHR$(135);
460 RETURN
470 'check ship blown upand print
480 EXEC 32000:EXEC 32200:IF FS=0 THEN GOSUB430
490 PRINT@S,"";
500 EXEC 32400
510 IF PEEK(32096)=255 THEN GOTO 1270
520 PRINTSH$;
530 RETURN
540 'fire laser
550 IF PEEK(65280)<>254 AND PEEK(65280)<>126 THEN RETU
RN
560 EXEC 32300
570 PLAY"T255L255CD"
580 RETURN
590 'blank ship
600 PRINT@S1,STRING$(4,128);:RETURN
610 'general print
620 POKE 32095,0
630 IF VE=0 THEN GOSUB 540
640 GOSUB 300
650 GOSUB 370
660 IF VE=0 THEN GOSUB 210
670 GOSUB 590
680 GOSUB 470
690 RETURN
700 'stage 1
710 FS=0
720 ST=1
730 FOR N=1 TO 100
```

(continued on page 182)

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(continued from page 180)

```
740 GOSUB 610
750 NEXT N
760 'stage 2
770 ST=2
780 I2=1:M2=1:FORN=1 TO 5:GOSUB 610:NEXT N:M1=1:I1=7
790 FOR N=1 TO 100:GOSUB610:NEXT N
800 'stage 3
810 ST=3
820 I2=1:M2=1
830 M2=1:FOR N=1 TO 4:GOSUB 610:NEXT
840 I1=8:M1=12
850 FOR N=1 TO 100
860 GOSUB 610
870 NEXT N
880 'stage 4
890 ST=4
900 FS=1
910 I1=13:M1=13
920 I2=1:M2=1
930 FOR N=1 TO 7:GOSUB 610:NEXT N
940 I1=1:M1=1:FOR N=1 TO 5:GOSUB 610:NEXT N
950 I2=13:M2=13
960 FOR N=1 TO 7:GOSUB 610:NEXT N
970 I2=3:M2=3
980 FOR N=1 TO 7:GOSUB 610:NEXT
990 I1=9:M1=9:FOR N=1 TO 3:GOSUB 610:NEXT N
1000 I1=8:M1=8:M2=4:I2=4:FOR N=1 TO 8:GOSUB 610:NEXT
1010 I1=1:M1=1:FOR N=1 TO 4:GOSUB 610:NEXT N
1020 I2=13:M2=13:FOR N=1 TO 19:GOSUB 610:NEXT N
1030 I2=1:M2=1:FOR N=1 TO 4:GOSUB 610:NEXT N
1040 M1=13:I1=13:FOR N=1 TO 6:GOSUB 610:NEXT N
1050 I1=12:M1=12:FOR N=1 TO 4:GOSUB 610:NEXT N
1060 I2=2:M2=2:FOR N=1 TO 7:GOSUB 610:NEXT N
1070 I2=1:M2=1:FOR N=1 TO 4:GOSUB 610:NEXT N
1080 I1=13:M1=13:FORN=1 TO 10:GOSUB 610:NEXT N
1090 I1=1:M1=1:FOR N=1 TO 4:GOSUB 610:NEXT N
1100 I2=13:M2=13:FOR N=1 TO 8:GOSUB 610:NEXT N
1110 I2=5:M2=5:FOR N=1 TO 7:GOSUB 610:NEXT N
1120 I1=6:M1=6:FOR N=1 TO 7:GOSUB 610:NEXT N
1130 'escaped zoron
1140 B$=CHR$(128)
1150 M1=1:I1=1:M2=1:I2=1:[illegible]
1160 FOR N=1 TO 32:GOSUB 610:NEXT N
1170 PRINT@172,"well";B$;"done";
1180 PRINT@227,"you";B$;"have";B$;"managed";B$;"to";B$
;"escape";
1190 PLAY"O4T8L4CF4CF4CF4CF4CF4CF4CF4CF4CO3"
1200 IF E1>.96 THEN E1=E1-.02
1210 SC=SC+500
1220 IF SC>HI THEN HI=SC
1230 TT=TT+1:IF TT=1 THEN PRINT@332,"bonus";B$;"ship";
:LI=LI+1:PLAY"O2L4CCDCEEEEGGGGO+CCCL1C"
1240 ST=1
1250 M1=3:M2=11:I1=1:I=6
1260 FOR N=1 TO 400:NEXT N:GOSUB 1740:GOTO 1330
1270 'ship hit
1280 PLAY"T255L255";PRINT@S,STRING$(4,255);:FOR N=1 TO
 31:PLAY"V"+STR$(N)+"C":NEXT N
1290 PRINT@S-33,CHR$(249);CHR$(128);CHR$(250);CHR$(128
);CHR$(128);CHR$(246);:IF S>480 THEN PRINT@S+31,CHR$(2
46);CHR$(128);CHR$(128);CHR$(245);CHR$(128);CHR$(249);
1300 PLAY"O1GABAGFGAGFFFGFEDEFEDCDEDCO3"
1310 IF VE=1 THEN GOTO 1610
1320 LI=LI-1:IF LI=0 THEN GOTO 1370
1330 FOR N=1 TO 500:NEXT N:GOSUB 1740:PRINT@192,"CAN Y
OU PENETRATE THE DEFENCES?";:PRINT@260,"";:FOR N=1 TO
LI:PRINTSHIP;CHR$(128);:NEXT N
1340 PLAY"O4T8L4CO-EF6GEF6EL1CO3":FOR N=1 TO 1000:NEXT
 N
1350 POKE 8,26
1360 S=256:GOSUB 1740:ON ST GOTO 700,760,800,880
1370 PRINT@266,"GAME OVER!";
1380 PLAY"T8L4O4AGFEFEDL2CO3"
1390 'check for high score
1400 FOR N=1 TO 10
1410 IF SC>S(N) THEN GOTO 1630
1420 NEXT N
1430 'not high score
1440 'display scores
1450 CLS
1460 PRINT"           HIGH SCORES"
1470 FOR N=1 TO 10
1480 PRINT USING"     %% %%%%%% %       %";N;S(N);N$(
N)
1490 NEXT N
1500 PRINT:PRINT"   PRESS ANY BUTTON TO PLAY"
1510 FOR N=1 TO 500
1520 IF PEEK(65280)=254 OR PEEK(65280)=126 OR INKEY$>"
" THEN GOTO 50
1530 NEXT N
1540 S=256:S1=256
1550 FS=0
1560 SC=0:GOSUB 1740
1570 VE=1
1580 H1=1:H2=1:M1=5:M2=5:I1=1:I2=1
1590 GOSUB 610
1600 IF PEEK(65280)=126 OR PEEK(65280)=254 OR INKEY$>"
" THEN 50 ELSE 1580
1610 FOR N=1 TO 1000:NEXT N
1620 GOTO 1440
1630 'enter high score
1640 FOR M=9 TO N STEP -1
1650 S(M+1)=S(M)
1660 N$(M+1)=N$(M)
1670 NEXT M
1680 CLS
1690 PRINT"          great score"
1700 PRINT:PRINT:PRINT:PRINT"   PLEASE ENTER YOUR NAME
"
1710 INPUT"......";N$(N)
1720 S(N)=SC
1730 GOTO 1440
1740 'reset screen
1750 CLS0:PRINTUSING"%%%%%     TUNNEL RUN      %%%%%"
;SC;HI;:PRINTSTRING$(32,&HFF);:PRINT@480,STRING$(31,&H
9F);:POKE 1535,&H9F
1760 RETURN
1770 'instructions
1780 CLS
1790 PRINT@227,"DO YOU NEED INSTRUCTIONS?"
1800 A$=INKEY$:IF A$<>"Y" AND A$<>"N" THEN GOTO 1800
1810 IF A$="N" THEN 50
1820 CLS
1830 PRINTTAB(11);"TUNNEL RUN"
1840 PRINT:PRINT:PRINT
1850 PRINT"YOUR MISSION:"
1860 PRINT:PRINT"TO ESCAPE FROM THE PLANET zoron"
1870 PRINT"BY FLYING THROUGH THE MAIN "
1880 PRINT"TUNNEL AND SHOOTING AS MANY       ALIENS AND
MISSILES AS POSSIBLE!"
1890 PRINT:PRINT"PRESS SPACE"
1900 IF INKEY$<>" " THEN 1900
1910 CLS
1920 PRINT"  THERE ARE FOUR DIFFERENT        STAGES TO P
ASS AS FOLLOWS"
1930 PRINT"stage 1"
1940 PRINT"  A TUNNEL WITH A FAIRLY WIDE   GAP."
1950 PRINT"stage 2"
1960 PRINT"  A STAGE WITH TALL PILLARS       WITH SMALL
AND LARGE GAPS IN     BETWEEN THEM."
1970 PRINT"stage 3"
1980 PRINT"   A HIGH FORTRESS,VERY TRICKY  AT POINTS."
1990 PRINT:PRINT"PRESS SPACE BAR"
2000 IF INKEY$<>" " THEN 2000
2010 CLS
2020 PRINT"stage 4"
2030 PRINT"   THE MAZE,THIS NEEDS A LOT OF PRACTICE TO
 MASTER AND CONSISTSOF A TUNNEL WITH CHAMBERS WHICH A
RE VERY THIN!"
2040 PRINT"PRESS SPACE TO START"
2050 IF INKEY$=" " THEN RETURN ELSE 2050
2060 GOTO 2060
2070 'load machine code into memory
2080 CLS:PRINTTAB(11);"TUNNEL RUN"
2090 PRINT@234,"LOADING CODE"
2100 POKE &HFFD7,0
2110 READ A$
2120 IF A$="*" THEN RETURN ELSE IF A$="?" THEN READ X:
GOTO 2110
2130 POKE X,VAL("&H"+A$)
2140 X=X+1
2150 GOTO 2110
2160 DATA ?,32000,8E,04,20,86,0F,87,7D,63,C6,1F,A6,89,
00,01,A7,84,30,01,C6,FF,26,F4,86,80,A7,84,30,01,86,7D,
63,4A,26,E7,8E,05,FF,86,7D,62,C6,9F,E7,84,30,10,30,10,
4A,26,F7,8E,04,3F,86,7E,61,C6,9F,E7,84,30,0F,30,0F,30,
07,4A,26
2170 DATA F5,39
2180 DATA ?,32100,8E,04,00,A6,84,81,87,26,06,86,85,A7,
89,FF,E0,30,01,8C,05,FF,26,ED,39
2190 DATA ?,32200,8E,04,00,A6,84,81,85,26,12,86,80,A7,
84,A6,89,FF,E0,81,80,26,06,86,85,A7,89,FF,E0,30,01,8C,
05,FF,26,E1,39
2200 DATA ?,32300,9E,88,C6,1A,A6,84,81,80,27,10,81,9F,
27,0B,81,0F,27,07,86,80,A7,84,B7,7D,5F,39,86,F3,A7,84,
30,01,C8,FF,26,E0,39
2210 DATA ?,32400,9E,88,C6,04,A6,84,81,80,27,06,86,FF,
B7,7D,60,39,30,01,C8,FF,26,EF,86,00,B7,7D,60,39
2220 DATA ?,32450,8E,04,00,A6,84,81,F3,26,04,86,80,A7,
84,30,01,8C,05,FF,26,EF,39
2230 DATA *
```

Verify

Man Wagstaff,
Richmond,
North Yorkshire.

BBC

THE USUAL METHODS of checking that a program has been recorded satsifactorily are to enter

*CAT or *L. " "8000

and then replay the tape. Unfortunately, these methods simply check that there is something on the tape. No check with the actual program in the machine is made. This program provides such a facility.

It is written in assembler language to produce the necessary machine code-routine. As it stands the code starts at &C00 but it is relocatable and can be assembled anywhere in RAM so as not to interfere with the program which is to be recorded — alter line 4.

Enter the listing shown, record it and then Run it. Rewind the tape to replay the recording and enter

CALL &00

You are now using the machine code to check that your recording of the assembly language listing is OK. If all is well you should see the program's name followed eventually by "Verified OK". If you get the message "Failed-record it again" then what is on tape does not agree with what you have in the machine.

For other programs, assemble the machine code somewhere convenient in RAM. Record your program, rewind the tape to the start of your progrm and then Call the start address of the machine code.

```
1REM        VERIFY
2REM A. WAGSTAFF 1983
3FORF%=0TO1
4P%=&C00
5[OPT F%*2
6LDA#0
7STA&70
8LDA&18
9STA&71
10LDA#&40
11LDX#3
12LDY#&C3
13JSR&FFCE
14TAX
15LDY#0
16.title
17LDA&3D2,Y
18BEQ begin
19JSR&FFE3
20INY
21BPL title
22.begin
23TXA
24TAY
25.bget
26JSR&FFD7
27BCC char
28CMP#&FE
29BEQ eof
30.err
31BRK:]
32P%=P%+1
33$P%="Failed _ record
it again"
34P%=P%+24
35[OPT F%*2
36 .eof
37BRK:]
38P%=P%+1
39$P%="Verified OK"
40P%=P%+11
41[OPT F%*2
42BRK
43.char
44STA&72
45LDY#0
46LDA(&70),Y
47CMP&72
48BNE err
49INC&70
50BNE cont
51INC&71
52.cont
53TXA
54TAY
55BPL bget:]
56NEXT
```

Self delete

David Gribble,
Tackley,
Oxfordshire.

ZX-81

MANY USEFUL utilities have been published for the Sinclair ZX-81 eg., dissassembler, memory left, hex loader etc.

(continued on page 184)

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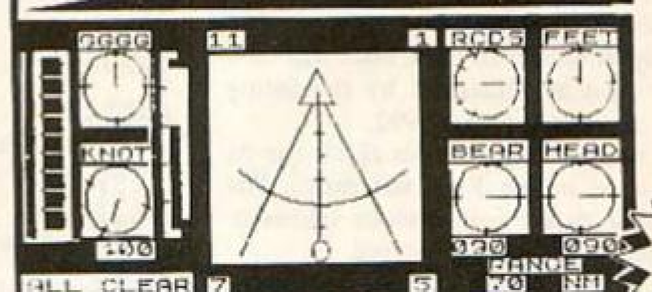

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(continued from page 182)

I have found these to be most useful for development of machine-code programs by including them all in a starter program which can be loaded from tape before commencing the machine-code program. This however raises a problem when the machine code is completed as I then have more than a hundred Basic lines to delete to leave the new program in a finished state without surplus statements.

My solution to this problem is to add one more routine to the starter program. The purpose of this routine is to delete all Basic line numbers within a range, input simply as a start and end number. The routine can safely delete itself!

The program to delete the lines is a machine-code routine consisting of 94 bytes held in a Rem statement.

Initially the hex code in the left-hand columns of the illustration are entered into a line 1 Rem statement using the hex loader and may be checked using the hex display Basic lines.

Do not delete the loader and display lines at this stage because the completed program will do this for you.

Use the Edit function of the ZX-81 to create line 9982 being a duplicate of line 1, enter lines 9980 to 9994.

Save a copy at this stage to guard against any possible errors in the entered program. Enter Run 9980 and respond to the start and end number requests using 1 and 230 respectively. If all is well these lines will then no longer exist as illustrated by the listing following the report code 0/9992.

If all is not well then double check the 94 byte hex code in the Rem statement. The program will detect any obvious inconsistencies in the line numbers entered.

For old ROM machines three changes are necessary to line 1 before it is edited to line 9982. These are:

POKE 16519,32
POKE 16526,40
POKE 16606,258

Entered as direct commands these amend the underlined hex lines as follows.

CD 20 0F	CALL 3872
21 28 0F	LD HL 3880
C3 F8 19	JP 6648

The program as described will be of most interest to 16K users who write their programs in machine code. The finished program will, however, work on a 1K machine provided that the loader and display lines are deleted in the normal way before lines 9980 to 9994 are created.

Self-delete machine code.

```
00000000                                                   LINE1/2 DATA
CD230F              CALL 3875                              FAST
3B                  DEC   SP
3B                  DEC   SP
FDE1                POP   IY                               LOCATE ROUTINE IN MEM
21280F              LD    HL    3883                       SET "SLOW" RETURN
E3                  EX    (SP)  HL
0602                LD    B     2                          SET LOOPS=2
C5                  PUSH  BC
FD46F9              LD    B     IY-7                       SET LINE1 SEARCH
FD4EFA              LD    C     IY-6
1807     :----      JR          7
C5       :          PUSH  BC     ------<-------:           2ND LOOP ONLY
FD46FB   :          LD    B     IY-5           :           SET LINE2 SEARCH
FD4EFC   :          LD    C     IY-4           :
217C40   :-->--     LD    HL    16508          :           SET START ADDRESS
3E36     .-->--     LD    A     59             :
17       :          RLA                        :
23       :          INC   HL                   :
3E       :          CP    (HL)                 :           CHECK END PROG
2813     :          JR    Z     19 --->------  :
78       :          LD    A     B          :   :           CHECK HIGH BYTE
BE       :          CP    (HL)             :   :
380F     :          JR    C     15 --->------: :           FOUND
23       :          INC   HL             : :   :
2004     : :-<-     JR    NZ    4        : :   :
79       : :        LD    A     C        : :   :           CHECK LOW BYTE
BE       : :        CP    (HL)           : :   :
3807     : :        JR    C     7  --->--: :   :           FOUND
23       : :->-     INC   HL             : :   :
5E       :          LD    E     (HL)     : :   :
23       :          INC   HL             : :   :
56       :          LD    D     (HL)     : :   :
19       :          ADD   HL    DE       : :   :           CALC. START NEXT LINE
18E7     :--<--     JR          -25      : :   :           JUMP TO TEST
2B                  DEC   HL         ---<--: :   :
C1                  POP   BC         ---<------: :
E5                  PUSH  HL                       :
10D8                DJNZ        -40 --->---------:           LOOP FOR LINE 2
D1                  POP   DE                                 RETRIEVE ADDRESSES
E1                  POP   HL
FD210040            LD    IY    16384                        RESTORE IY
A7                  AND   A
ED52                SBC   HL    DE                           CALC. REDUCTION
D0                  RET   NC                                 MUG TRAP
44                  LD    B     H                            LOAD REDUCTION
4D                  LD    C     L
19                  ADD   HL    DE                           RESET ADDRESS
D5                  PUSH  DE                                 STORE HIGH ADDRESS
CDAD09              CALL  2477                               CHANGE POINTERS
EB                  EX    DE    HL                           LOW ADDRESS TO DE
2A0C40              LD    HL    (16396)                      SET "STOP"
222940              LD    16425 (HL)
E1                  POP   HL                                 HIGH ADDRESS TO HL
C3F919              JP    6649                               JUMP TO ROM LDIR
```

Basic driver for line deletions.

```
9980 REM CLEAR
9981 LET D = 5+256*PEEK 16426 + PEEK 16425
9982 REM XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX ETC
9983 PRINT " INPUT START ";
9984 FOR I = 0 TO 2 STEP 2
9985 INPUT L
9986 PRINT L
9987 IF I = 0 THEN LET L =L-1
9988 POKE D+I,INT(L/256)
9989 POKE D+I+1,L - 256*INT(L/256)
9990 PRINT AT 2,7;"END    ";
9991 NEXT I
9992 RAND USR(D+4)
9993 PRINT AT 5,2;"DUFF INPUT - TRY AGAIN";AT 0,0;
9994 GOTO 9980
```

Hex loader for line 1 Rem.

```
1      REM XXXXXXXXXXXXXXXXXXXX 94 X'S XXXXXXXXXXXXX
10     LET X=16514
20     LET A$=""
30     IF A$<>"" THEN GOTO 80
40     INPUT A$
50     PRINT AT 20,0;A$
60     SCROLL
70     IF A$="S" THEN STOP
80     POKE X,16*CODE A$ + CODE A$(2) -476
90     LET X=X+1
100    LET A$=A$(3 TO )
110    GOTO 30
HEX DISPLAY FOR CHECKING.
200    FOR I=0 TO 93
210    LET A = PEEK(16514+I)
220    PRINT CHR$(INT(A/16)+28);CHR$(A-16*(INT(A/16))+28)
230    NEXT I
```

Tri-pixel plotter

Kenneth Baker,
Bitterne,
Southampton.

SPECTRUM

THIS SHORT ROUTINE will allow you to Plot several pixels at the same time, giving the effect of a thick line.

The technique used is to Plot normally, Save the position, then Plot the positions on either side of the original in both the x and y

```
1 REM tri-pixel plotter
4 DATA 237,75,125,92,197,121
5 DATA 254,255,40,4,12,205
6 DATA 223,34,193,197,121,254
7 DATA 0,40,4,13,205,223
8 DATA 34,193,197,120,254,0
9 DATA 40,4,5,205,223,34
10 DATA 193,197,120,254,175,40
11 DATA 4,4,205,223,34,193
12 DATA 237,67,125,92,201
13 CLEAR 49999
14 LET A=50000
15 FOR N=1 TO 53
16 READ B: POKE A,B
17 LET A=A+1
18 NEXT N
```

dimensions, before restoring the original position for the next move.

It is especially useful for distinguishing between two plotted routines, as the example sine wave program will illustrate — where one curve is plotted normally, and the other using this routine.

There are only 53 bytes in the routine, which can be entered at any convenient place in memory; and lines 13 and 14 of the Loader program and line 70 of the sample program can be changed accordingly. The programs should be saved before they are run.

A hex dump is also provided for those with suitable resources.

Sample program.

```
10 FOR N=0 TO 255
20 PLOT N,80+80*SIN (N/128*PI)
30 NEXT N
40 DRAW -255,0
50 FOR N=0 TO 255
60 PLOT N,80-80*SIN (N/128*PI)
70 RANDOMIZE USR 50000
80 NEXT N
```

Catalog

VIC-20

CBM-64

M J Curtis,
Stalbridge,
Dorset.

THIS PROGRAM IS intended to be put at the beginning of the user's program tape to keep a record of program names and the tape counter reading of programs on the tape.

Although the program does not really need any instructions here is a summary of the options and what they do.

When Run the program displays a menu of five options. Option 1 will search for a record with any part matching the search string. If no record is found the program prints a message and sounds a beep.

Option 2 will list all the records prompting for a Return with every full screen.

Option 3 is for entering new records, first the program name is entered, then the tape counter reading.

Option 4 allows editing records. The records are searched as in option 1 and the first record found is displayed and the program asks if this is the record to be edited: if no then the program returns to the menu. After the revised record has been entered it is printed on the screen and the user is asked if it is OK. If no the process is repeated, a yes returns you to the menu.

Option 5 ends the program. If any data has been added or altered the program prompts for the tape to be rewound and then the usual prompts for Saving programs. There is no option for deleting a record, however it is possible to delete a record by editing it and inputting the new name as * — an asterisk. The line will then be ignored, but the number of records will be misleading until a new record is added.

The data is input in a novel way by Poking it into dummy Data statements in the program area. The Data statements are read until the asterisk — signifying an empty record — is found. The line number of the current data statement can be found by

PEEK(63) + 256 * PEEK(64)

This information is then used to calculate the location that the input data must be Poked so that it appears correctly in the program Data statements. It is for this reason that it is vital that lines 5 to 260 must be typed in exactly as shown. It would be a good idea to Save the program after typing in, as any error will probably be fatal when Run.

It is very important that no line with a number less than 300 be altered so that it

(continued on page 187)

```
5 REM(C)M.J.CURTIS 1983
10 GOTO700
200 DATA1001
201 DATACATALOG------------000
202 DATA**********************
203 DATA**********************
204 DATA**********************
205 DATA**********************
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256 DATA**********************
257 DATA**********************
258 DATA**********************
259 DATA**********************
260 DATA**********************

300 INPUT"PRESS RETURN";D$:PRINT"J":RETURN
310 IFPEEK(214)>19THENGOSUB300
320 RETURN
325 POKE36878,15:POKE36875,225:FORJ=0TO200:NEXT:POKE36878,0:RETURN
330 N=0:FORJ=1TOR:READF$:IFLEFT$(F$,1)="*"THEN360
340 FORI=1TO19-LEN(S$):IFMID$(F$,I,LEN(S$))=S$THENPRINTF$:GOSUB310:N=N+1:IFC=4T
HENRETURN
350 NEXTI
360 NEXTJ:IF(C=1)AND(N>0)THENPRINT"THATS ALL"
370 IFN=0THENPRINTTAB(4)"NO RECORD FOUND":GOSUB325
380 RETURN
390 PRINT"J":INPUT"SEARCH KEY";S$:PRINT"J";TAB(6)"SEARCHING":GOSUB330:GOSUB30
0:RETURN
400 PRINT"J";H$:FORI=1TOR:IFR=0THENRETURN
410 READF$:IFLEFT$(F$,1)="*"THEN430
420 PRINTF$:GOSUB310
430 NEXT:GOSUB300:RETURN
440 PRINT"J":IFR>59THENPRINTTAB(7)"NO ROOM":GOSUB325:FORI=1TO2000:NEXTI:RETUR
N
450 P$="":INPUT"PROG. NAME";P$:IFLEN(P$)>19ORP$=""THEN450
460 C$="":INPUT"TAPE COUNT";C$:IFLEN(C$)>3ORC$=""THEN460
470 IFLEN(P$)<19THENP$=P$+"-":GOTO470
480 IFLEN(C$)<3THENC$="0"+C$:GOTO480
490 P$=P$+C$:IFC=4THENRETURN
500 N=0:FORI=1TOR:READF$
510 IFLEFT$(F$,1)="*"THENN=1:GOTO530
520 NEXTI:IFN=0THENREADF$:R=R+1
530 L=PEEK(63)+PEEK(64)*256:A=S+48+(L-201)*28
540 FORI=ATOA+21:POKEI,ASC(MID$(P$,I+1-A,1)):NEXTI
550 H=1:IFC=4THENRETURN
560 RESTORE:READF:A=S+38:IFN=0THENF=F+1
570 F$=STR$(F):FORI=2TOLEN(F$):POKEA+I-2,ASC(MID$(F$,I,1)):NEXTI:RETURN
580 PRINT"J":INPUT"SEARCH KEY";S$:GOSUB330:IFN=0THENFORI=1TO2000:NEXTI:RETURN
600 PRINT"DO YOU WISH TO EDIT   THIS LINE":INPUT"Y/N ";D$:IFLEFT$(D$,1)<>"Y"THE
NRETURN
610 GOSUB450:PRINTP$:INPUT"OK Y/N";D$:IFLEFT$(D$,1)<>"Y"THEN610
620 GOSUB530:RETURN
630 IFH=0THENEND
640 INPUT"REWIND TAPE THEN PRESS RETURN";D$:SAVE"CATALOG":END
700 RESTORE:READF:R=F-1000:S=PEEK(43)+PEEK(44)*256:H$="PROG.NAME        TAPE
COUNT"
705 POKE36879,223
710 PRINT"J";R;"RECORDS STORED":PRINT60-R;"SPACES LEFT":PRINT"SEARCH FOR RECOR
D (1)"
720 PRINT"LIST ALL RECORDS  (2) ENTER NEW RECORD  (3)"
730 PRINT"EDIT A RECORD      (4) END               (5)"
740 PRINT"";:INPUT"OPTION";D$:C=VAL(D$):IFC<1ORC>5THEN710
750 ONCGOSUB390,400,440,580,630:GOTO700
```

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(continued from page 185)
changes in length.

The program is written so that it will run on a Vic-20 of any size and with changes to the sound routine in line 325 and the screen colour Poke in line 705 will run on the CBM-64. The number of Data satements can be increased on expanded machines provided they are of the same length. As the program does not change in length when data is added it can be re-saved in the same space on the tape. It is considerably more convient to use the program if it is the first program on the tape as it is necessary to Save the program whenever new data is added.

The following is a short explanation of the program lines, more in order of execution than the way they are listed.

Lines 700 to 730 look for the start of Basic and print the menu. The option selected is input in line 740 and is checked for validity, the appropriate subroutine is selected in line 750.

The search option is handled in line 390 but most of the work is done in lines 330 to 380. Line 330 reads the Data statements and look for an asterisk. The check for a match with the search string is done in line 340. The subroutine call to line 310 checks for a full screen of records. If the screen is full this in turn calls the subroutine in line 300 which suspends operations until Return is pressed. Line 360 prints 'That's all' when the search is exhausted. Line 370 produces the "No Record Found" message and sounds the tone — line 325. Lines 400 to 430 print out all the records, checking for full screens and waiting at the end of the list for another Return. Lines 440 to 570 handle data input. The size of the list is checked in line 440 to see if there is enough room for another entry. Lines 450 to 490 input the information to be stored and fill the spaces with hyphens.

The check for C = 4 — option 4 — is present as lines 450 to 490 are used again in the editing option. The first empty record is found in lines 500 to 520 and lines 530 calculates the address to start Poking the data into place n line 540. Lines 560 and 570 do the same for the first data statement — line 200 — which is the number of records + 1000. The edit option is managed in lines 580 to 620 mostly by using parts of other routines, this allows a lot of program to be squeezed into a small space. Lines 630 and 640 end the program, if data has been added or altered line 640 prompts for the tape to be rewound and then does the Save.

Lines 5 to 260 must be typed in exactly as in the listing — including the Rem — but with no space between the line number and the first character of data. The data in lines 202 to 260 consist of twenty two asterisks. When the program is Run your input data will appear in these lines.

A model universe

W Roy Masefield, Holland-on-Sea, Essex.

SPECTRUM

THE MOTION of two bodies under the influence of gravity — the so-called two-body problem of classical mechanics — lends itself very well to demonstration by computer. The mathematics of the problem is quite straightforward, involving nothing more than Newton's Laws of Force and Motion. The possible demonstrations include such things as the capture of one astronomical body by another; orbits of satellites; behaviour of binary stars and so on, given only the starting data.

Figure 1.

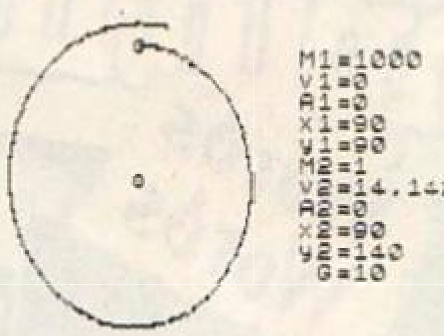
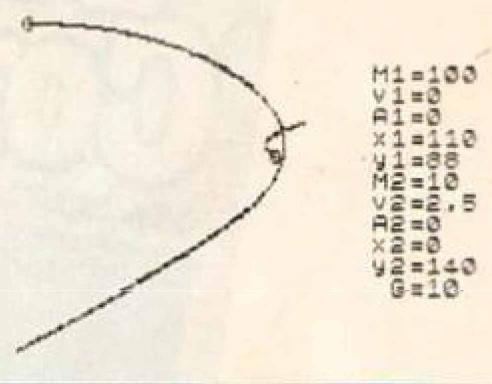


Figure 2.



When the program is Run, the data is called for, and to give you some idea of suitable values to start with, I suggest you try out those given in figures 1 to 5. Then, when you get the feel of it, to try your own values. Angles, by the way, are entered in degrees — the program converts these to radians as required by the ZX-Spectrum — with zero being the east direction. Negative values for the angles are legitimate.

The initial positions of the two bodies are entered as x and y co-ordinates, these being the normal pixel co-ordinates of the Spectrum, but do not go above x=170 because the right-hand quarter of the screen is

(continued on page 189)

```
   5 REM "MU" Model Universe
   6 REM © W.R.Masefield 1983
  10 REM Input Data
  20 CLS : PRINT "MODEL UNIVERSE
": PRINT
  30 INPUT "First Body: Mass? ";
m1,"Velocity? ";v1,"Angle? ";a1,
"x coord? ";x1,"y coord? ";y1,"S
econd Body: Mass? ";m2,"Velocity
? ";v2,"Angle? ";a2,"x coord? ";
x2,"y coord? ";y2,"Gravitational
 Constant? ";g: CLS
  40 PRINT TAB 23;"M1=";m1: PRIN
T TAB 23;"v1=";v1: PRINT TAB 23;
"A1=";a1: PRINT TAB 23;"x1=";x1:
 PRINT TAB 23;"y1=";y1: PRINT TA
B 23;"M2=";m2: PRINT TAB 23;"v2=
";v2: PRINT TAB 23;"A2=";a2: PRI
NT TAB 23;"x2=";x2: PRINT TAB 23
;"y2=";y2: PRINT TAB 24;"G=";g
  50 LET dt=0.1: LET a1=a1*PI/18
0: LET a2=a2*PI/180: LET x1=x1+1
0: LET x2=x2+10
  60 CIRCLE x1,y1,2: CIRCLE x2,y
2,2
  70 LET v1x=v1*COS a1: LET v2x=
v2*COS a2
  80 LET v1y=v1*SIN a1: LET v2y=
v2*SIN a2
 100 REM Processing
 110 LET fg=g*m1*m2/((x2-x1)*(x2
-x1)+(y2-y1)*(y2-y1))
 120 IF x2=x1 THEN LET phi=PI/2:
 GO TO 140
 130 LET phi=ATN ABS ((y2-y1)/(x
2-x1))
 140 LET f1x=fg*COS phi*SGN (x2-
x1): LET f2x=-f1x
 150 LET f1y=fg*SIN phi*SGN (y2-
y1): LET f2y=-f1y
 160 LET a1x=f1x/m1: LET a2x=f2x
/m2
 170 LET s1x=v1x*dt+a1x*dt*dt/2:
 LET s2x=v2x*dt+a2x*dt*dt/2
 180 LET v1x=v1x+a1x*dt: LET v2x
=v2x+a2x*dt
 190 LET a1y=f1y/m1: LET a2y=f2y
/m2
 200 LET s1y=v1y*dt+a1y*dt*dt/2:
 LET s2y=v2y*dt+a2y*dt*dt/2
 210 LET v1y=v1y+a1y*dt: LET v2y
=v2y+a2y*dt
 300 REM Plot
 310 PLOT x1,y1: DRAW s1x,s1y: P
LOT x2,y2: DRAW s2x,s2y
 320 LET x1=x1+s1x: LET x2=x2+s2
x
 330 LET y1=y1+s1y: LET y2=y2+s2
y
 340 GO TO 100
```

(continued from page 187)

reserved for displaying the starting data. When all the data is entered, the program starts to plot the paths. It is not fast, but fascinating to watch. Plotting continues until one of the curves runs off the edge of the screen area, but plotting can be stopped at any point by Break.

A look, now, at some of the possible demonstrations:

Figure 1: This shows a small mass orbiting a much larger one.

Figure 2: In this, a small body approaches a more massive body at an oblique angle to the direction of the gravitational force. The larger body is initially at rest. The smaller body is pulled out of its straight-line path and traces a near-parabola, and the larger body is given some motion and it begins to trace out a curved path.

Figure 3: Binary stars are illustrated here. One star is larger than the other, and each has been given the required tangential velocity for a circular orbit round the common centre of gravity. Try other velocities and see what happens:

Figure 4: This is an Earth-Moon simulation. The larger body is given a velocity as if in orbit round the sun. As we are looking at only a short piece of this orbit, the lack of curvature does not matter. The smaller mass is given the velocity calculated to keep it in orbit, plus the velocity of the larger.

The resultant paths are fair approximations to what actually happens with the Earth-Moon system; the moon performs a series of loops and the Earth, because of the mutual gravitational action, does a series of cycloid-like loops. Certainly, the Earth's path is not a smooth one.

Figure 5: For fun, we may see what happens when the force of gravity is repulsive instead of attractive, i.e., when we have the anti-gravity of science-fiction.

To do this, enter a negative value for the gravitational constant. The figure shows two equal masses approaching each other almost, but not quite, in a direct line. See if you can interpret what is happening if they *are* in an exact head-on course.

Adventurous programmers might like to develop this program further by including action under electric forces. In this case, instead of F_g, we shall have F_E, which depends on the electric charges (q) carried by the bodies:

$$F_E = \frac{kq_1q_2}{d^2}$$

The motions resulting from this force behave exactly as for gravitation, i.e., they depend on the masses of the bodies.

Figure 3.

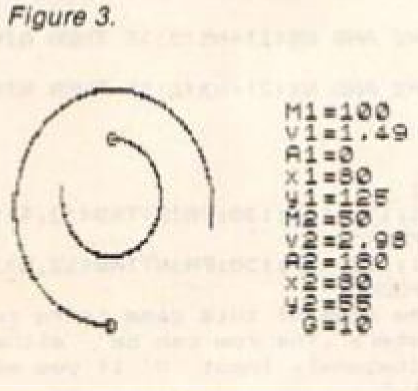


Figure 4.

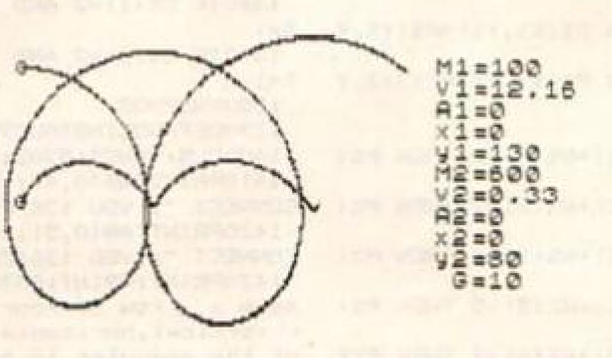
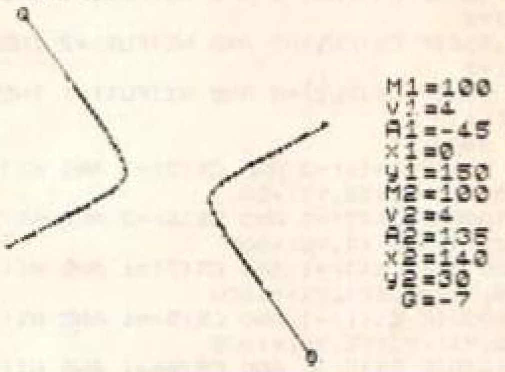


Figure 5.



Connect Four

A Cregeen,
Braddan,
Isle of Man,

BBC

IN CONNECT FOUR for the BBC Model B or Electron the idea is to create a row of four counters. Full instructions are given in the program. It plays a pretty mean game and you will have to be on your toes to outwit it. Average response time is eight seconds. A help facility is included if you are completely stuck.

```
   10*TV 255
   20MODE7
   30PROCINSTRUCTIONS
   40DIM A%(7,6),P%(7,6),C%(7),N%(7),CHOOSE(5),CHOOSEY
(5)
   50MODE5
   60PROCDRAWBOARD
   70PROCENTERMOVE
   80IF H$="HELP" THEN GOTO 130
   90PROCFINDY
  100PROCWIN(H%,R%)
  110PROCDRAWCOUNTER(H%,R%,1)
  120IF WIN%=1 THEN PRINTTAB(0,28);"You win!
                      ":PROCNEWGO:RUN
  130PRINTTAB(0,28);"Thinking..."
  140PROCMYMOVE
  150IF H$="HELP" THEN PRINTTAB(0,26);"Try column '";U
%;"'":GOTO70
  160PROCDRAWCOUNTER(U%,I%,2)
  170IF P%(U%,I%)>900 THEN PRINTTAB(0,28);"I WIN !
          ":PROCNEWGO:RUN
  180PRINTTAB(0,28);"
      "
  200RY%=0
  210FOR AS%=1 TO 7:IF A%(AS%,1)<>0 THEN RY%=RY%+1
  220NEXT
  230IF RY%=7 THEN PRINTTAB(5,15);"D R A W":PROCNEWGO:
RUN
  235FOR VB%=1 TO 7:FOR FD%=1 TO 6:P%(VB%,FD%)=0:NEXT,
  240GOTO70
  250DEFPROCDRAWBOARD
  260GCOL0,3
  270FOR F%=0 TO 7
  280MOVE (F%*181),1024
  290DRAW (F%*181),256
  300IF F%<>7 THEN PRINTTAB((F%*3),25);F%+1
  310NEXT
  320FOR F%=0 TO 6
  330MOVE 0,1020-(F%*128)
  340DRAW 1270,1020-(F%*128)
  350NEXT
  360ENDPROC
  370DEFPROCENTERMOVE
  380PRINTTAB(0,28);:INPUT"Which column",H$
  390PRINTTAB(0,28);"                        ";TAB(0,26);"
 "
  400IF H$="HELP" THEN ENDPROC
  410IF ASC(H$)<48 OR ASC(H$)>57 OR LEN(H$)>1 THEN GOT
O 380
  411IF A%((VAL(H$)),1)<>0 THEN GOTO 380
  420H%=VAL(H$)
  430ENDPROC
  440DEFPROCFINDY
  450W%=7:K%=0
  460REPEAT
  470W%=W%-1
  480IF A%(H%,W%)=0 THEN R%=W%:K%=1
  490UNTIL K%=1
  500ENDPROC
  510DEFPROCDRAWCOUNTER(X%,Y%,Z%)
  520GCOL0,Z%
  530IF Z%=2 THEN A%(X%,Y%)=1
  540IF Z%=1 THEN A%(X%,Y%)=2
  550Y%=1020-(Y%*128)
  560X%=X%*181
  570MOVEX%,Y%:MOVE X%-181,Y%:PLOT85,X%,Y%+128
  580PLOT85,X%-181,Y%+128
  590PROCDRAWBOARD
  600ENDPROC
  610DEFPROCMYMOVE
  620FOR X%=1 TO 7:FOR Y%=1 TO 6
  630M%=2:PROCSCAN(-1,-1,1,X%,Y%)
  640M%=2:PROCSCAN(-1,0,2,X%,Y%)
  650M%=2:PROCSCAN(-1,1,3,X%,Y%)
  660M%=2:PROCSCAN(0,1,4,X%,Y%)
  670M%=2:PROCSCAN(1,1,5,X%,Y%)
  680M%=2:PROCSCAN(1,0,6,X%,Y%)
  690M%=2:PROCSCAN(1,-1,7,X%,Y%)
  700PROCPTS(X%,Y%)
  710NEXTY%,X%
  720PROCCHOOSE
  730ENDPROC
```

(continued on next page)

(continued from previous page)

```
740DEFPROCSCAN(A%,B%,E%,X%,Y%)
750NT%=0
760IF Y%=6 THEN 780
770IF A%(X%,Y%+1)=0 THEN NT%=1:ENDPROC
780IFA%(X%,Y%)<>0 THEN NT%=1:ENDPROC
790IF X%+A%>7 OR Y%+B%>6 OR X%+A%<0 OR Y%+A%<0THEN C
%(E%)=0:N%(E%)=0:ENDPROC
800Z%=A%(X%+A%,Y%+B%)
810M%=2:G%=0
820REPEAT
830J%=M%*A%:O%=M%*B%
840IF X%+J%<1 OR Y%+O%<1 OR Y%+O%>6 OR X%+J%>7 THEN
V%=10 ELSE V%=A%(X%+J%,Y%+O%)
850IF Z%<>V% THEN C%(E%)=Z%:N%(E%)=(M%-1)
860M%=M%+1
870UNTIL Z%<>V%
880ENDPROC
890DEFPROCPTS(X%,Y%)
900IF NT%=1 THEN P%(X%,Y%)=-10000:ENDPROC
910FOR FU%=1 TO 7
920IF C%(FU%)=1 AND N%(FU%)=3 THEN P%(X%,Y%)=P%(X%,Y
%)+1000
930IF C%(FU%)=2 AND N%(FU%)=3 THEN P%(X%,Y%)=P%(X%,Y
%)+50
940IF C%(FU%)=1 AND N%(FU%)=2 THEN P%(X%,Y%)=P%(X%,Y
%)+3
950IF C%(FU%)=1 AND N%(FU%)=1 THEN P%(X%,Y%)=P%(X%,Y
%)+2
960IF C%(FU%)=2 AND N%(FU%)=2 THEN P%(X%,Y%)=P%(X%,Y
%)+3
970IF C%(FU%)=2 AND N%(FU%)=1 THEN P%(X%,Y%)=P%(X%,Y
%)+1
980NEXT
990IF C%(1)=2 AND C%(5)=2 AND N%(1)+N%(5)>2 THEN P%(
X%,Y%)=P%(X%,Y%)+50
1000IF C%(2)=2 AND C%(6)=2 AND N%(2)+N%(6)>2 THEN P%(
X%,Y%)=P%(X%,Y%)+50
1010IF C%(3)=1 AND C%(7)=1 AND N%(3)+N%(7)>2 THEN P%(
X%,Y%)=P%(X%,Y%)+1000
1020IF C%(1)=1 AND C%(5)=1 AND N%(1)+N%(5)>2 THEN P%(
X%,Y%)=P%(X%,Y%)+1000
1030IF C%(2)=1 AND C%(6)=1 AND N%(2)+N%(6)>2 THEN P%(
X%,Y%)=P%(X%,Y%)+1000
1040IF C%(3)=2 AND C%(7)=2 AND N%(3)+N%(7)>2 THEN P%(
X%,Y%)=P%(X%,Y%)+50
1050IF Y%>1 THEN A%(X%,Y%)=1:PROCWIN(X%,Y%-1)
1060A%(X%,Y%)=0
1070IF WIN%=1 THEN P%(X%,Y%)=P%(X%,Y%)-50
1080ENDPROC
1090DEFPROCCHOOSE
1100A%=0:B%=0
1110FOR Q%=1 TO 7:FOR SW%=1 TO 6
1120A%=P%(Q%,SW%)
1130IF A%>B% THEN B%=A%
1140NEXT,
1150TR%=0
1160FOR Q%=1 TO 7:FOR SW%=1 TO 6
1170IF P%(Q%,SW%)=B% AND TR%<5 THEN TR%=TR%+1:CHOOSE(
TR%)=Q%:CHOOSEY(TR%)=SW%
1180NEXT,
1190RANDOM%=INT(RND(TR%))
1200IF RANDOM%=0 THEN RANDOM%=1
1210UX%=CHOOSE(RANDOM%):I%=CHOOSEY(RANDOM%)
1220ENDPROC
1230DEFPROCWIN(H1%,R1%)
1240WIN%=0
1250PROCSCAN(-1,-1,1,H1%,R1%)
1260PROCSCAN(-1,0,2,H1%,R1%)
1270PROCSCAN(-1,1,3,H1%,R1%)
1280PROCSCAN(0,1,4,H1%,R1%)
1290PROCSCAN(1,1,5,H1%,R1%)
1300PROCSCAN(1,0,6,H1%,R1%)
1310PROCSCAN(1,-1,7,H1%,R1%)
1320FOR FO%=1 TO 7
1330IF C%(FO%)=2 AND N%(FO%)=3 THEN WIN%=1
1340NEXT
1350IF C%(3)=2 AND C%(7)=2 AND N%(3)+N%(7)>2 THEN WIN
%=1
1360IF C%(1)=2 AND C%(5)=2 AND N%(1)+N%(5)>2 THEN WIN
%=1
1370IF C%(2)=2 AND C%(6)=2 AND N%(2)+N%(6)>2 THEN WIN
%=1
1380ENDPROC
1390DEFPROCINSTRUCTIONS
1400CLS:VDU23;8202;0;0;0;
1410PRINTTAB(0,4);:VDU141;132;157;130:PRINTTAB(12,4)"
CONNECT ";:VDU 136:PRINT"FOUR"
1420PRINTTAB(0,5);:VDU141;132;157;130:PRINTTAB(12,5)"
CONNECT ";:VDU 136:PRINT"FOUR"
1430PRINT:PRINT:PRINT" The idea of this game is to cr
eate a   row of four 'counters'.The row can be   eithe
r vertical,horizontal or diagonal. Input '0' if you wa
nt the computer to gofirst."
1440PRINT" Type 'HELP' for some friendly advice   whe
n you are stuck.

      PRESS SPACE BAR TO CONTNUE"
1450VCX$=GET$:CLS
1460ENDPROC
1470DEFPROCNEWGO
1480PRINTTAB(0,29);"PRESS ANY KEY...":A$=GET$:ENDPROC
```

Searcher

T Peacock,
Brighton,
Sussex.

DRAGON

THIS MACHINE-CODE program for the Dragon 32 solves the problem of finding the end of a long program on tape when you are stuck in the middle.

Typing Exec will turn the audio on and the motor on and for as long as the signal is present, the motor will remain on so that the tape stops at the end of the program. ■

```
10 DATA 86,BC,B7,FF,23,B7,FF,01
20 DATA 86,3C,B7,FF,21,86,37,B7
30 DATA FF,03,10,8E,FF,FF,31,3F
40 DATA 26,FC,4F,86,00,B7,7F,FF
50 DATA 86,FF,F6,FF,22,C1,07,26
60 DATA 0F,4A,81,00,26,F4,86,00
70 DATA B1,7F,FF,27,0B,7E,7D,1A
80 DATA C6,01,F7,7F,FF,7E,7D,29
90 DATA BD,BD,DC,39
100 FOR I=1 TO 68
110 READ A$:POKE 31999+I,VAL("&H"+A$)
120 NEXT I
130 FOR I=1 TO 68:A=A+PEEK(31999+I):NEXT I
140 IF A<>8834 THEN PRINT "ERROR"
```

```
10 CLEAR 200,32000
20 EXEC&HCFFA
30 ORG 32000
40 @START LDA £188
50 STA $FF23
60 STA $FF01
70 LDA £60
80 STA $FF21
90 LDA £55
100 STA $FF03
110 LDY £$FFFF:@DELAY
LEAY -1,Y:BNE @DELAY
120 @MID CLRA
130 LDA £0
140 STA $7FFF
150 LDA £255
160 @LOOP LDB $FF22
170 CMPB £7
180 BNE @FLAG
190 @CONT DECA
200 CMPA £0
210 BNE @LOOP
220 LDA £0
230 CMPA $7FFF
240 BEQ @MOTOFF
250 JMP @MID
260 @FLAG LDB £1
270 STB $7FFF
280 JMP @CONT
290 @MOTOFF JSR 48604
300 RTS
310 END @START
```

SCISOFT EDUCATIONAL SOFTWARE FOR MICRO COMPUTERS

All of Scisoft's programs have been comprehensively tested and are regularly used in schools. Please note that the pupil, parent or teacher should check with the syllabus to make sure that all the components of the packages are relevant. Some Boards may not require knowledge of all the contents of our packages.

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Improve your child's reading. Written by experts in reading skills. Designed to complement reading skills taught in schools. Simple to use, but extremely sophisticated programs utilising some machine code and most of a 48K machine.
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Set a test, or a quiz, learn foreign language vocabulary. Multi-purpose program which holds 10 sets of 10 words for 45 children (Spectrum version). A game can be played at the end of the test but only if the child obtains a high score. A versatile and useful program which can be used in all subject ares in a school, at home and even at parties! The Spectrum package also has 3 extra sets of the program containing tests on (1) French Vocabulary (2) Junior Spelling (3) General Knowledge.

NEW

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Add, Subtract, Multiply, Divide. One of our most popular programs. The teacher or parent has full control over the level of difficulty, the type of problem and the time allowed. The child has to cross a jungle answering problems on the way. Getting an answer wrong results in a death too horrible to contemplate.

ASTRO MATHS (7-15 YRS)

Fractions, Decimals, Percentages. For every two correct answers the child plays a space game and thus saves his ship from destruction. Level and time allowed is set by the teacher or parent.

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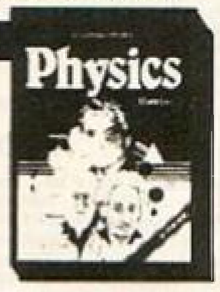
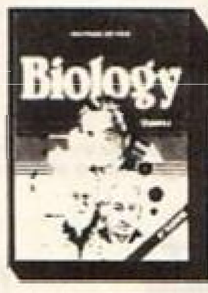
All the programs have been produced by very experienced teachers. They all contain problems to be solved on the major themes of the relevant examination syllabuses. Wherever possible the problems contain randomised data, so that the programs can be used time and time again with increasing benefit. Most packs also contain sets of multiple choice questions typical of those found in examination papers. Complete with a comprehensive book of REVISION NOTES. Extremely useful as examination day approaches. All packs contain a program of hints on HOW TO REVISE AT HOME. Written to be compatible with most O-Level Boards and also useful for the most able CSE pupil.

PHYSICS



Two programs full of problems. Ohm's Law, Refraction, Resistances, Linear Expansion, Moments etc., etc., 5 sets of multiple choice questions. Book of notes. Hints on revision. Fantastic value.



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An identification program which requires knowledge of Vitamins, Minerals and Carbohydrates. Genetics program, multiple choice questions and superb diagram plus questions on the alimentary canal, kidney, flower structure. Book of notes. Hints on revision.

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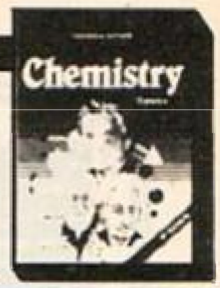
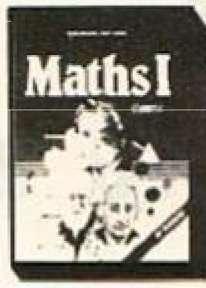


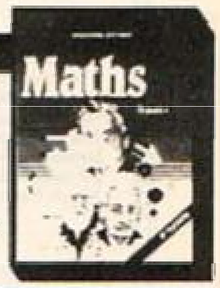
Two programs full of problems. Gas Laws, Molarity, Titrations, Mystery Compounds etc. 3 sets of multiple choice problems. Book of notes. Hints on revision. Very good use of graphics.



MATHS PART I

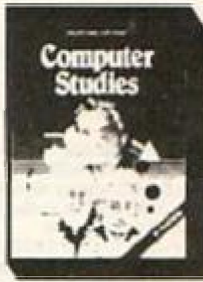
Problems with random data on:- Algebra, Equations, Functions, Areas, Perimeters and Volumes. Book of notes. Hints on revision.
A real must for all children.

MATHS PART II



A series of programs designed to complement PART I. Problems with random data on:- Proportions, Percentages, Differentiation, Integration, Trigonometry. Book of notes. Hints on revision.

NEW



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MARK BOOK	£8.00	£10.00	-	-
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* Also suitable for Model A, but not Electron

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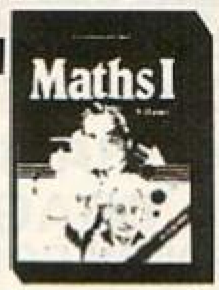
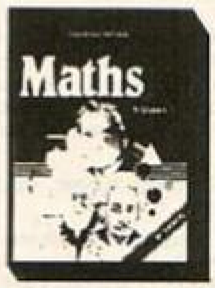


5 programs per pack. Exciting and stimulating program that makes maths fun to learn and understand.
Part I — draw symmetrical patterns; find the factors; compare fractions; use co-ordinates by playing battleships; 'guess' the shape.

NEW



Part II — run a lemonade stand; use logic in Towers of Hanoi; design a shape and view a 3D representation at different angles; 'guess' the percentage; run a small lemonade business. Superb value for money.

FRENCH

A truly remarkable package of programs. Describe a picture; test your vocabulary using a variety of novel ideas; put sentences in the correct sequence. A new and novel way of learning a foreign language.

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The German version of the above package.

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COMPETITION *of the year* RESULTS

DECEMBER'S COMPETITION of the year drew an enormous number of entries. We counted them all in, 1624 of them. Nearly two thirds were correct — a surprisingly high proportion in view of how tough the puzzles were. Some competitors claimed they had cracked the maze in a matter of hours; other had sweated over it all Christmas long. As D Purdue, Newcastle put it "the Christmas tree maze kept me busy for days (weeks wouldn't rhyme)". He wins one of the Atari games consoles, for his pains

Puzzle B seemed to be the one which gave the most trouble. To solve it you needed to notice that every group of four shapes contains a pair of the same shape and two different shapes.

There were at least three possible routes through the grid in puzzle H making all three answers correct. Was this intentional or not? We will probably never know.

All the other puzzles had only one solution so there were three winning sequences through the maze. They are (1) A,B,H,D,J,I,F,G,C,E; (2) A,B,H,C,E,D,J,I,F,G; (3) A,B,H,G, C,E,D,J,I,F.

T Llewellyn-Jones thought we had blundered and suggested in his tie breaker that he would need a prize to keep quiet about puzzle H. To award him a major prize would be to bow to threats but he certainly deserves a binder. M Stefanyszyn, 2 Ridgemount Close, Brockworth, Gloucester, went one better and supplied a program — given here — to prove that there were three solutions. He clearly does not need instruction at an Anchor Hotel and probably would not appreciate a games console so he wins the second prize of an Advance model A. His tie-breaker read "then your 'Your Computer' computer will be my, my, my computer".

As the great majority of the tie-breaking sentences made a play on the word 'advance', we decided to make one of these the winner. S Hall, 62 Woodland Rise, Muswell Hill, London N10. wins the first prize of an Advance Model B with the short but effective "I'd love an advance but the bank says no chance".

More than a hundred entries came from abroad. From Holland P van der Oever told us that "alien beatniks have double joy in floppy glittering computer examinations"; from Sweden P Johansson confessed "I'm a nut-cracker who wants to advance to a hacker"; from West Germany R. Zippelius wrote "I do not believe in miracles, I rely on them", while his fellow countryman K Reiner said simply "a German should be among the winners". Binders to all of these.

A Lambert plucked at your heart strings with "I trizes and I trizes but I never wins no prizes" and wins the second Atari games console.

Most entries read the opening sentence as "I should be among the Christmas prize winners . . ." rather than "I should be among the Christmas prizes . . .". F Ruspoli read it correctly and completed it with "I'm sweet and innocent" — which seems a good enough reason for being a prize. He wins one of the fourth prizes, a computer weekend at one of the Anchor Hotels. The other goes to R Ward for "I'm an advance on Santa Claus and cut to boot".

No jokes please about the fifth prize being two weekends at Anchor Hotels. Instead we offered ten hand-held CG. games, each with a built-in alarm clock. Awarding them was difficult since if you have set your sights on an £1200 Advance Model B you may not be too happy with a hand-held game. Still if you feel you are too old for Donkey Kong you can always pass it on to your children next Christmas.

Among the winning entries here were "I'm a fully integrated home system with a fifth generation personality" from Mrs Hastings; "I feel a thousand times astuter since getting hooked on Your Computer" from D Magrill; P Riley's "the only hard wear in my stocking is a hole"; M Peterson's "when it comes to competitions I'm a turkey"; and J Moore's "I got so wrapped up in this competition".

No less than five members of the Cherchian family bought December's issue to send in their entries. This is admirable and will boost our circulation figures to even dizzier heights. So B Cherchian also gains a CGL unit. The others go to K Offen, A Harris, J Devlin, N Carter.

The remaining binders have been won by P Koh, J Hubbard, J Gabb, P Ashby and J Crombie.

M Stefanyszyn's program to prove that there are three solutions to puzzle H.

```
 10 LET A$="1602536"
 20 LET B$="1431523"
 30 LET C$="4655342"
 40 LET D$="4042230"
 50 LET E$="1032261"
 60 LET F$="0115206"
 70 LET G$="4065435"
100 REM all routes thru grid
120 FOR A=1 TO 7
130 FOR B=A TO 7
140 FOR C=B TO 7
150 FOR D=C TO 7
160 FOR E=D TO 7
170 FOR F=E TO 7
190 DIM R(7): LET Q=0
200 REM A ROUTE THRU GRID
210 LET T$=A$( TO A)+B$(A TO B)
+C$(B TO C)+D$(C TO D)+E$(D TO E
)+F$(E TO F)+G$(F TO )
230 REM  ELIMINATE ROUTES WITH
240 REM 3 OR MORE SIMILAR CELLS
250 FOR T=1 TO 13
260 LET I=VAL T$(T)+1
270 LET R(I)=R(I)+1
280 IF R(I)>2 THEN LET Q=1
290 NEXT T
310 REM PRINT OUT VALID ROUTES
320 REM AND SOLUTION
330 IF Q=0 AND (R(3)<2 OR R(6)<
2 OR R(7)<2) THEN PRINT T$,(2*(R
(3)<2)+5*(R(6)<2)+6*(R(7)<2))
340 NEXT F: NEXT E: NEXT D
350 NEXT C: NEXT B: NEXT A
```

Above: Advance Model B — the first prize. Below: Advance Model A — the second prize.

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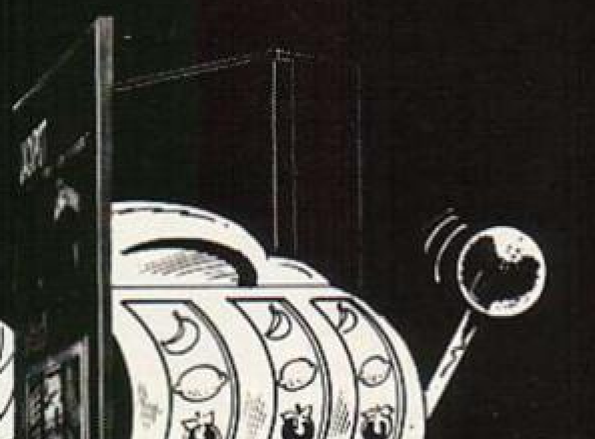
DERBY DAY for the 48K Spectrum **Only £5.95**
Gambling on any horse in the field, up to 5 players can lay bets with Honest Clive Spectrum the bookmaker. Watch the race begin as the tape lifts and marvel at the amazingly realistic 3D animation as the riders jockey for position. See the slow motion finish. Sound and colour used to its fullest in this 44K of superb programming. Not recommended for compulsive gamblers.

CAVEMAN for any ZX Spectrum **Only £4.95**
Enter the prehistoric world and discover the difficulties our forefathers had in obtaining food. The idea of the game is to pick your way across monster infested plains, and through treacherous mountain ranges to reach the Pterodactyl's lair.

STARGAZER SECRETS for the 48K Spectrum **Only £5.95**
The only serious Astrological forecaster produced for the 48K ZX Spectrum. Written by a professional Astrologer, it condenses Astrology's complex mathematics and relations into an easy to use program. By entering the subject's name and date, time and place of birth, the program quickly interprets the data, plots a Natal Chart and lists the results under a number of categories. A program that combines the newest art with the oldest Science.

CRAWLER for any ZX Spectrum **Only £4.95**
An addictive chase game needing both reaction and strategy. In fast machine code for arcade action.
You are Crawler and your aim in life is to hunt down and devour as many bugs as you can. Every time you catch one you grow longer, so that you soon have to avoid biting yourself! The more bugs you eat, the more difficult it becomes. You can choose between 9 skill levels.



JACKPOT for the 48K Spectrum **Only £4.95**
A complete simulation of a popular fruit machine, using definable graphics to the fullest. It contains a complete introduction to the rules of its HOLD, NUDGE, GAMBLE and FEATURE BOX with animated demo. Memory mapped reels, simultaneous revolution, staggered stop, animated bet and payout, payout board and realistic sound effects recreate the original. A must and a wallet saver for any fruit machine buff.

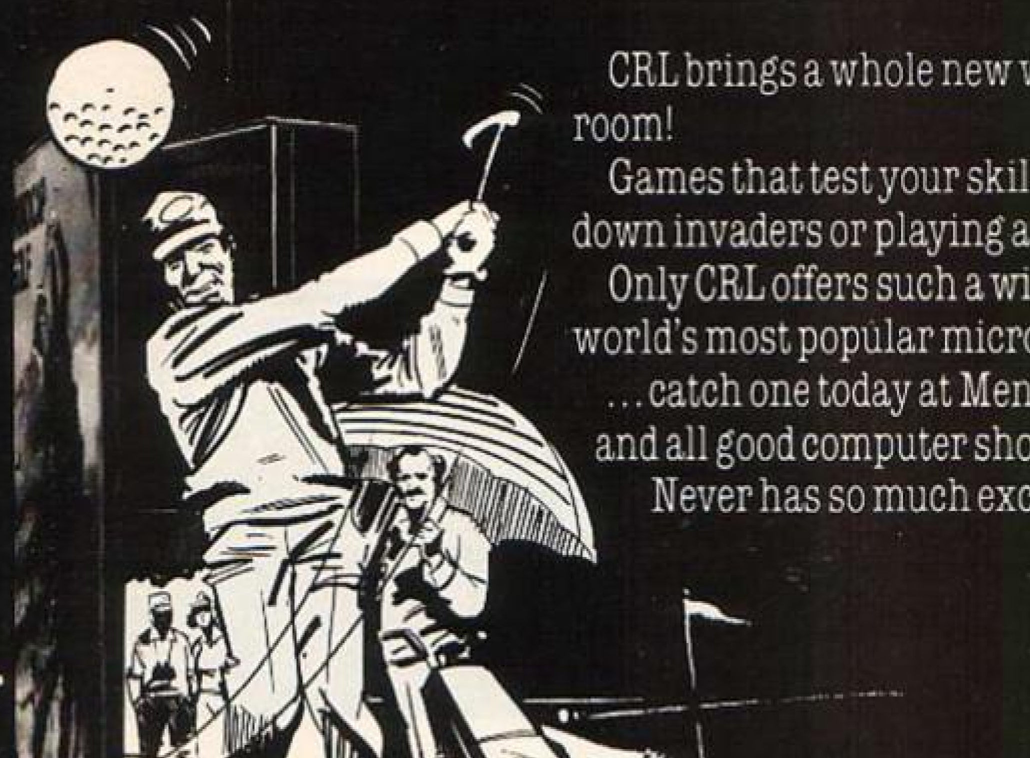
TEST MATCH for the 48K Spectrum **Only £5.95**
This is the No. 1 hit of the Summer and is a 3-D Test Match Cricket Simulation. Contains two programs – the first a full 5-day Test, the second a selection of one day matches. Each program contains a full scoreboard and definable teams. The game already contains England and Australia teams.

EXCITEMENT AND INTRIGUE.

RESCUE for the 48K Spectrum **Only £5.95**
An adventure game that needs a Special Program to detail its Rules! VERY simply, you must find the Map and Radio Men, plot your route and monitor patrols as they scour the 40 + locations you are travelling through. If you have the right equipment you can cross into Secret Territory in search of the Castle containing the imprisoned Princess. If you find the Princess, you must still return to base with her.

LUNAR RESCUE for any ZX Spectrum **Only £4.95**
A fast moving addictive program. In this game you are the pilot of a spaceship with orders to rescue stranded Astronauts from the Moon's ragged surface. Six astronauts are relying on you to save them, but you can only take one at a time. You will have to steer your craft through treacherous asteroid belts surrounding the moon.

3-D DESERT PATROL for any ZX Spectrum **Only £4.95**
A game of Strategy and reaction in 3 dimensions. You are the commander of a heavily armoured tank rumbling towards safety. You must avoid mines and enemy tanks. Your colour coded mine indicator will aid you across the dangerous enemy fields. Once across, you are vulnerable to enemy attack with only 50 shells available for retaliation.



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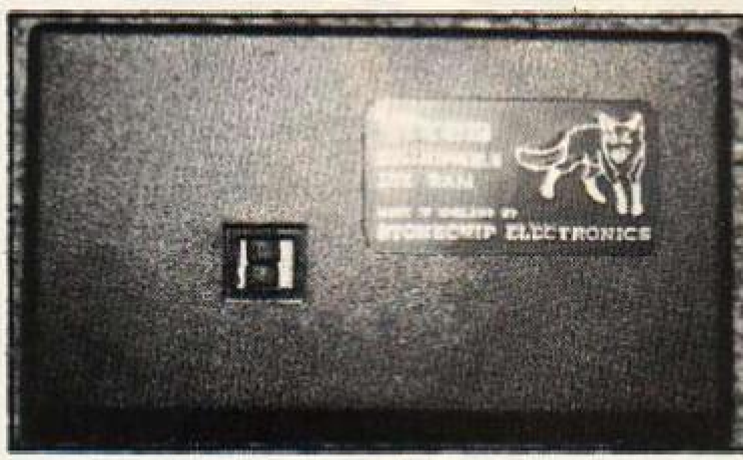

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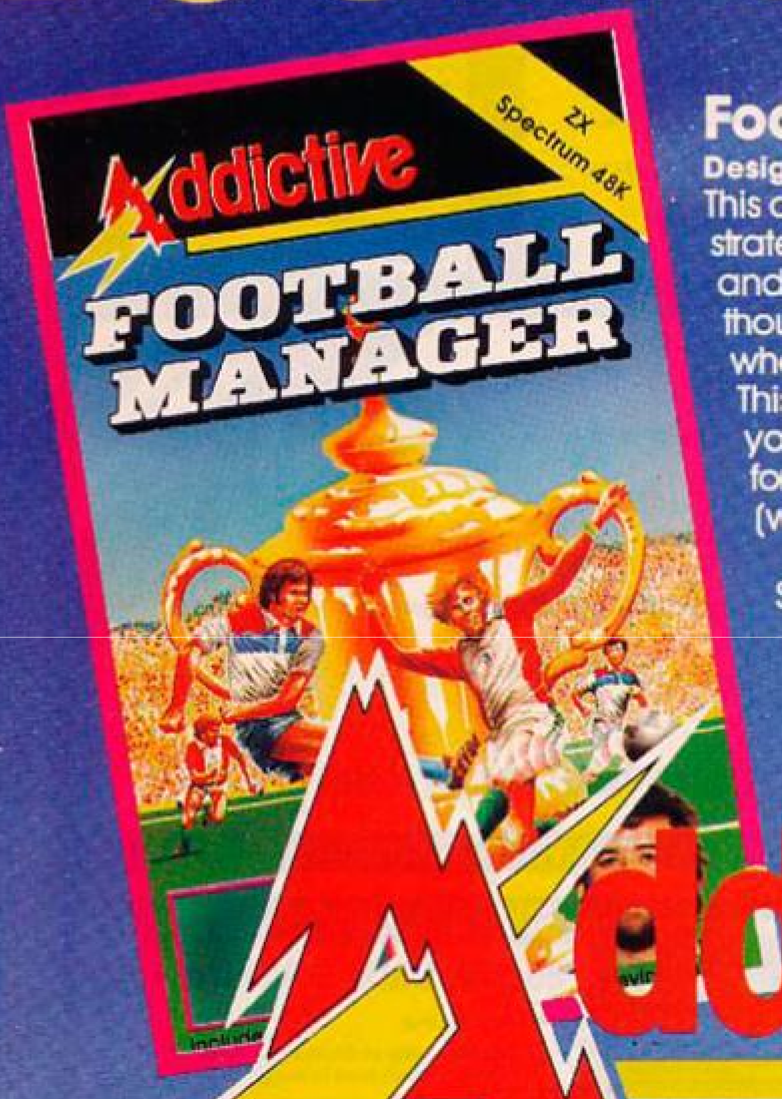

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*ZX81 Chart, Home Computing Weekly 16.8.83

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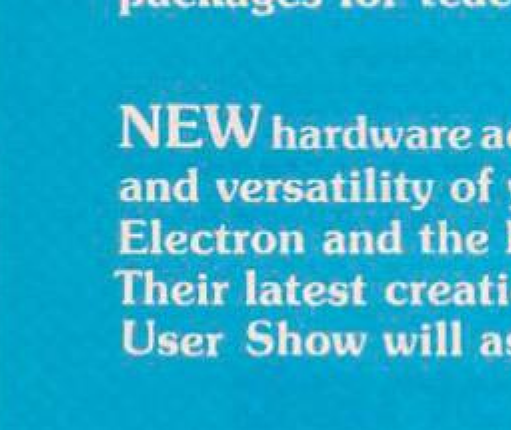

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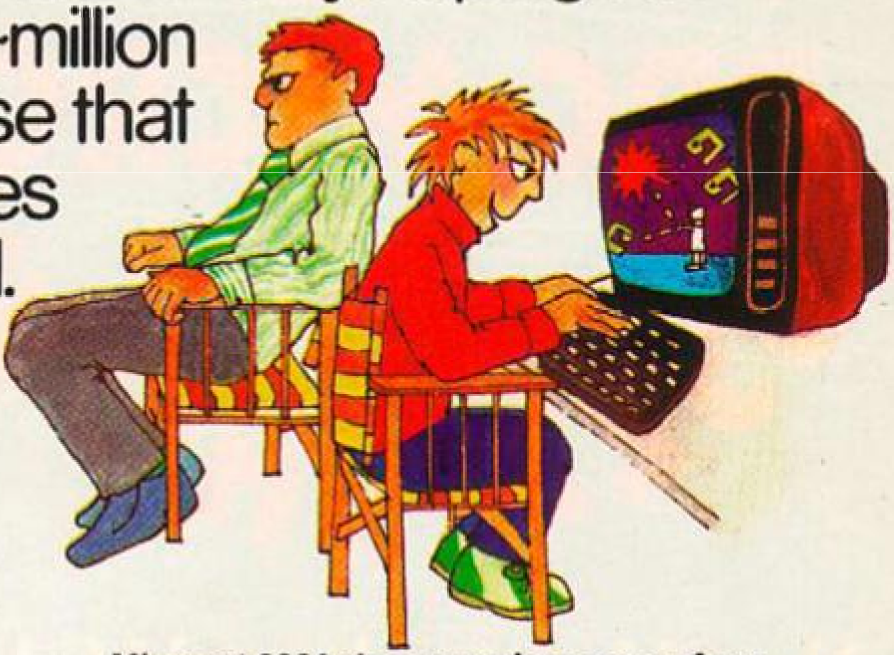

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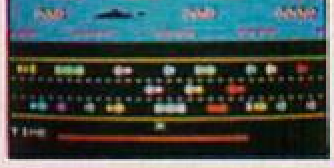

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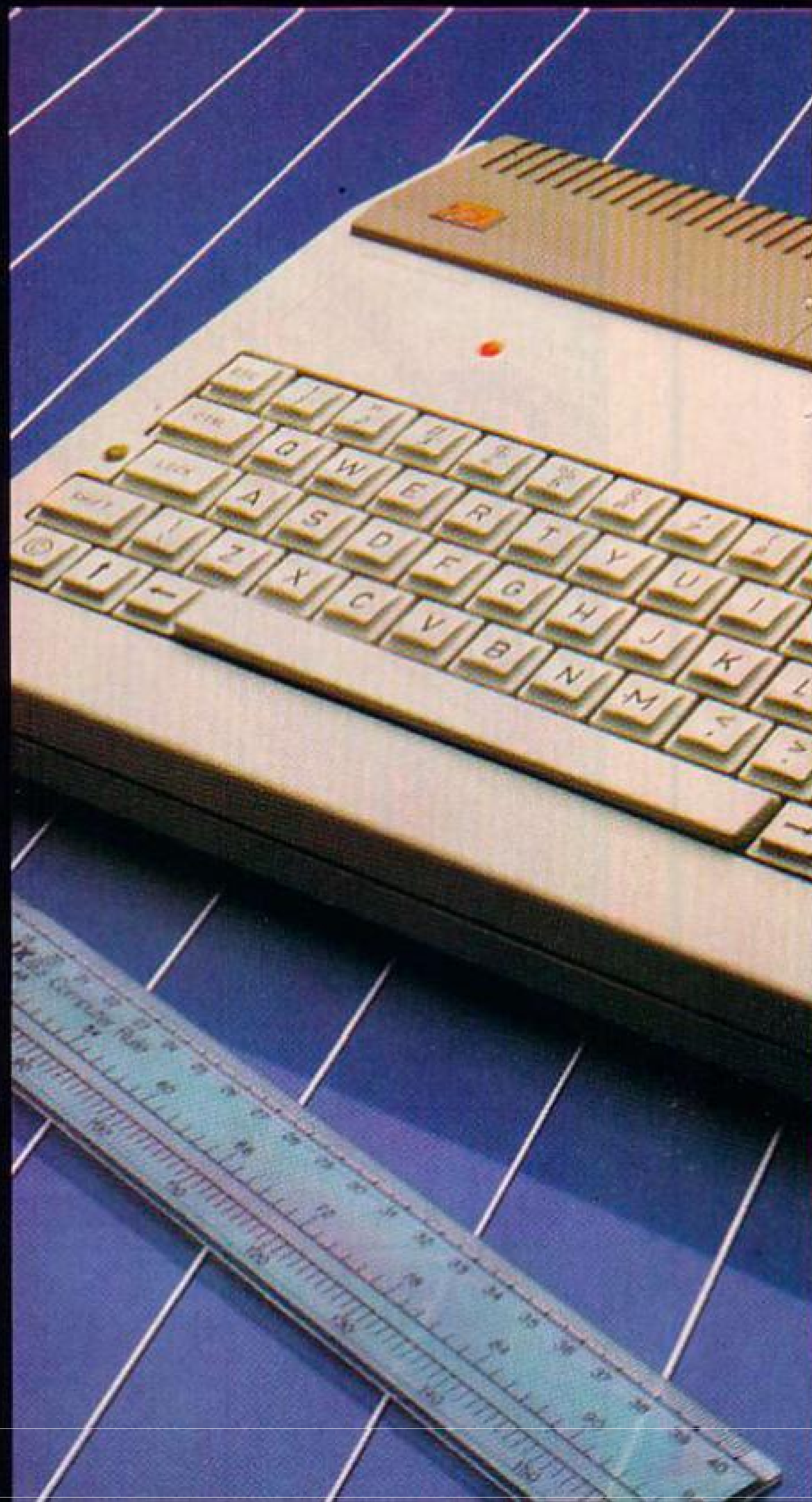

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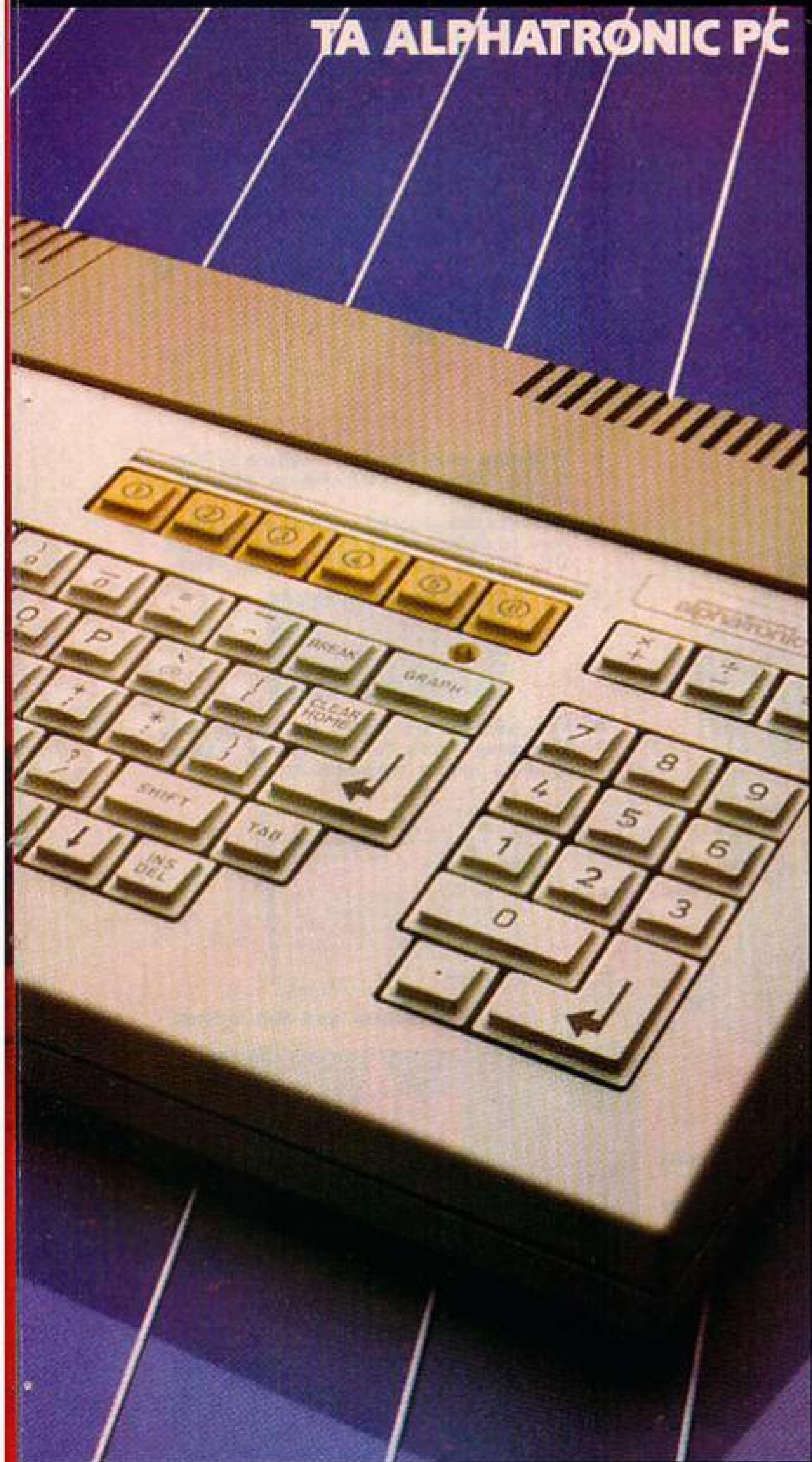

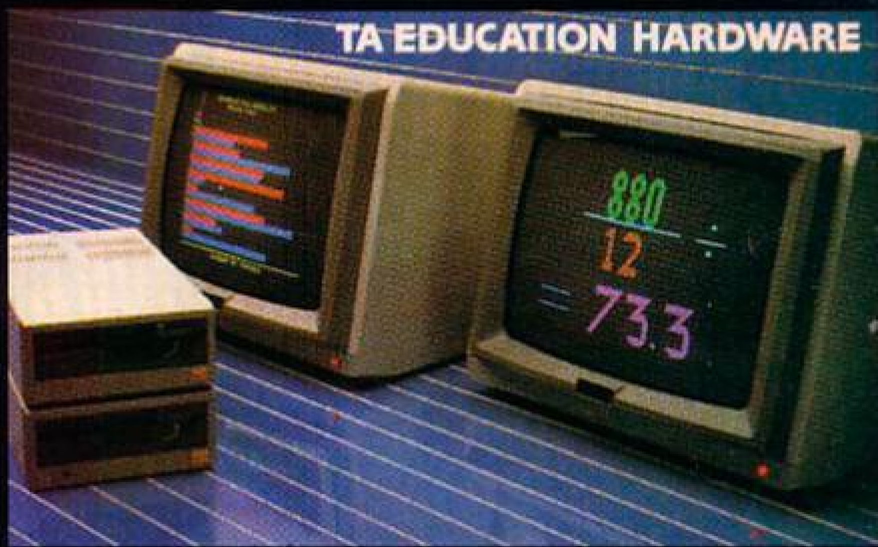

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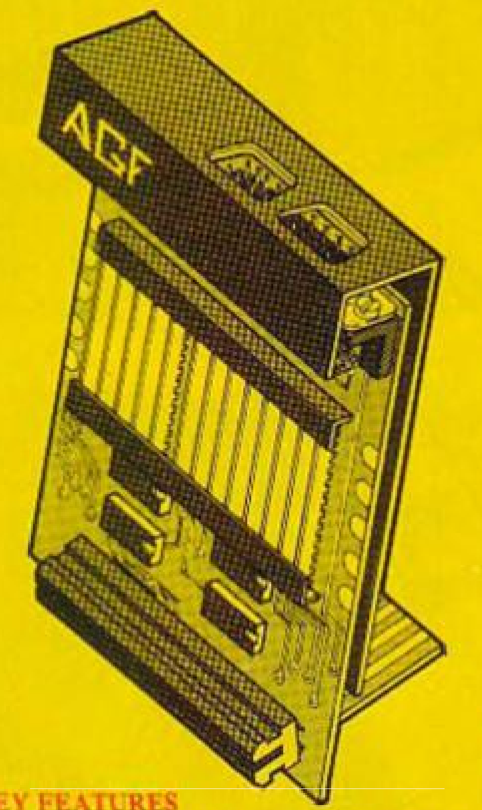

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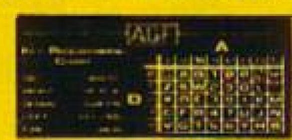

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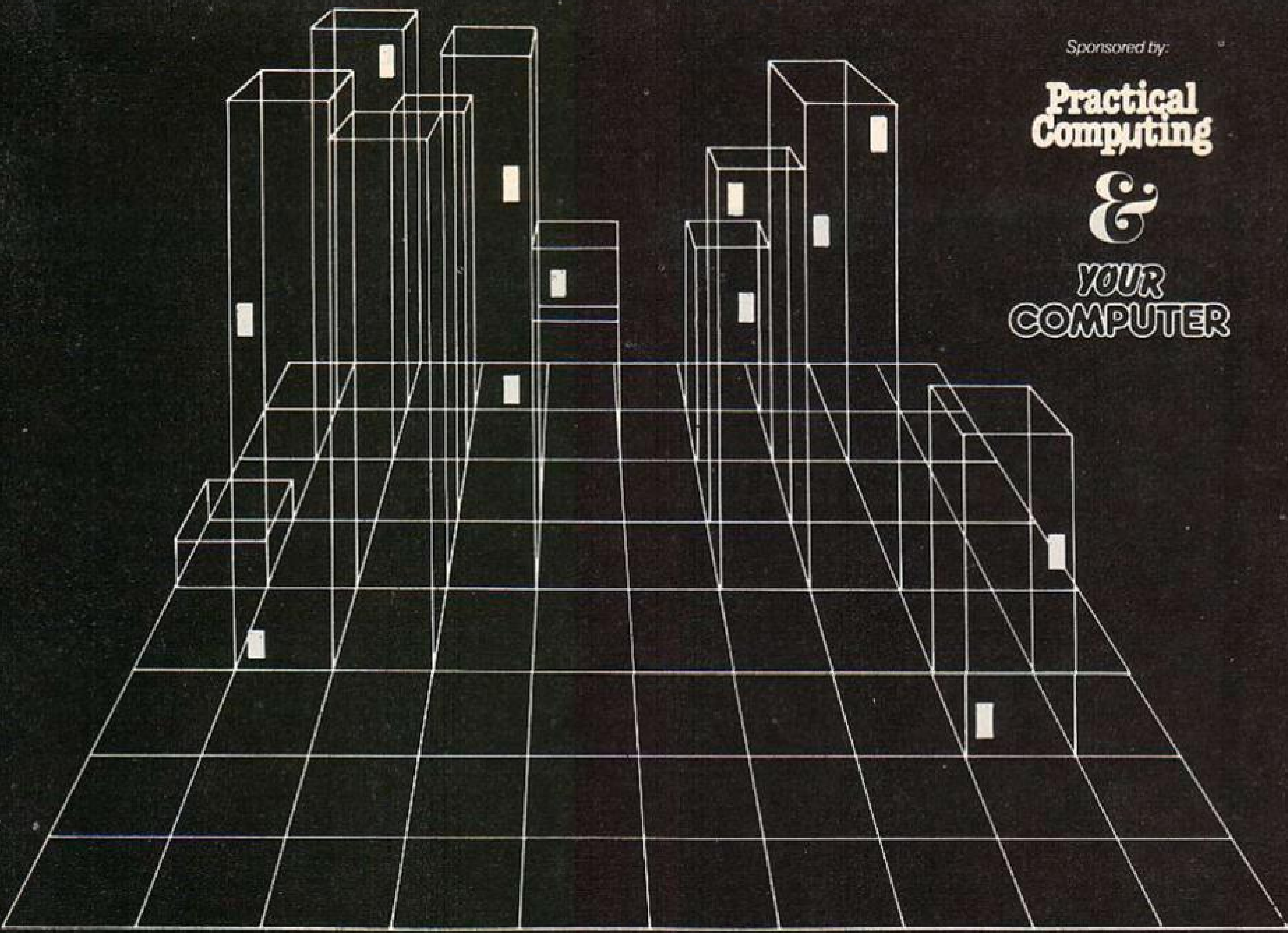

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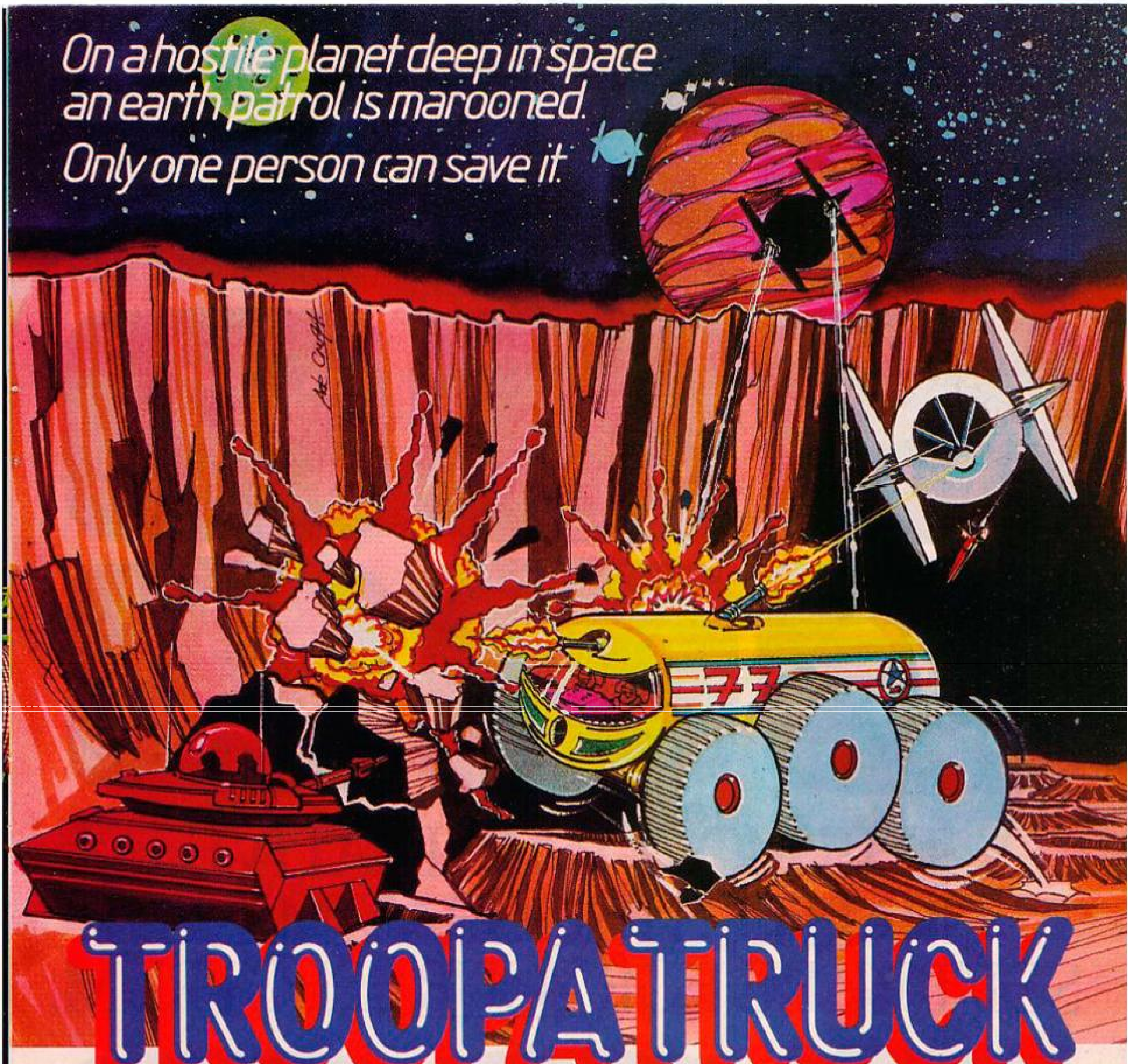

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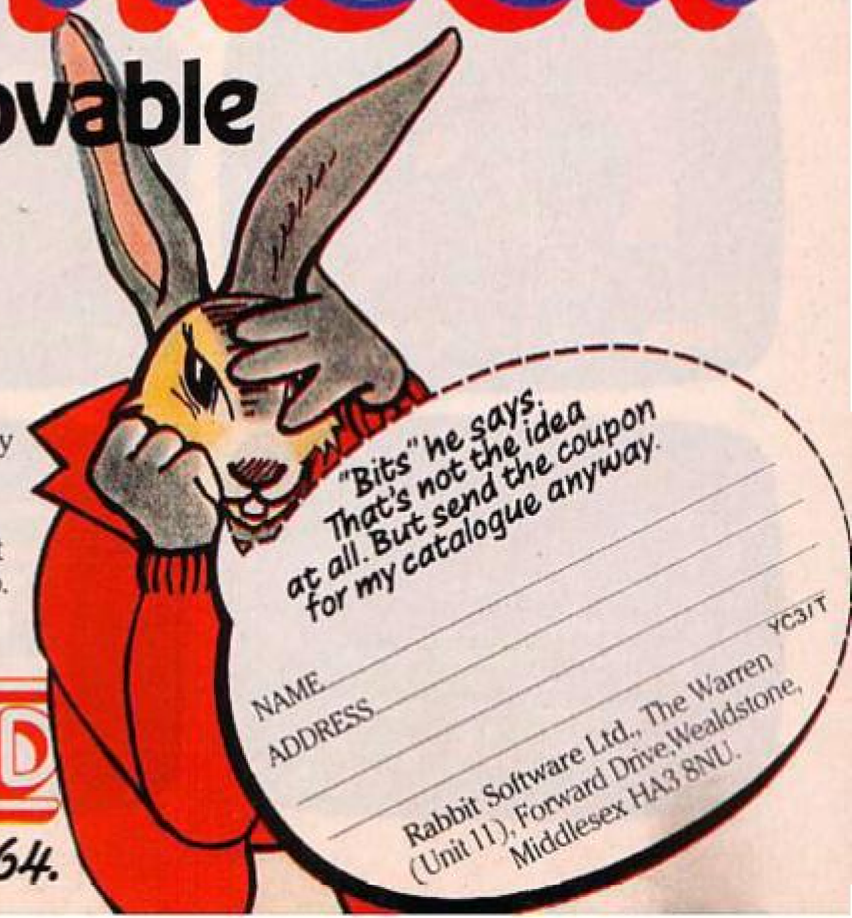

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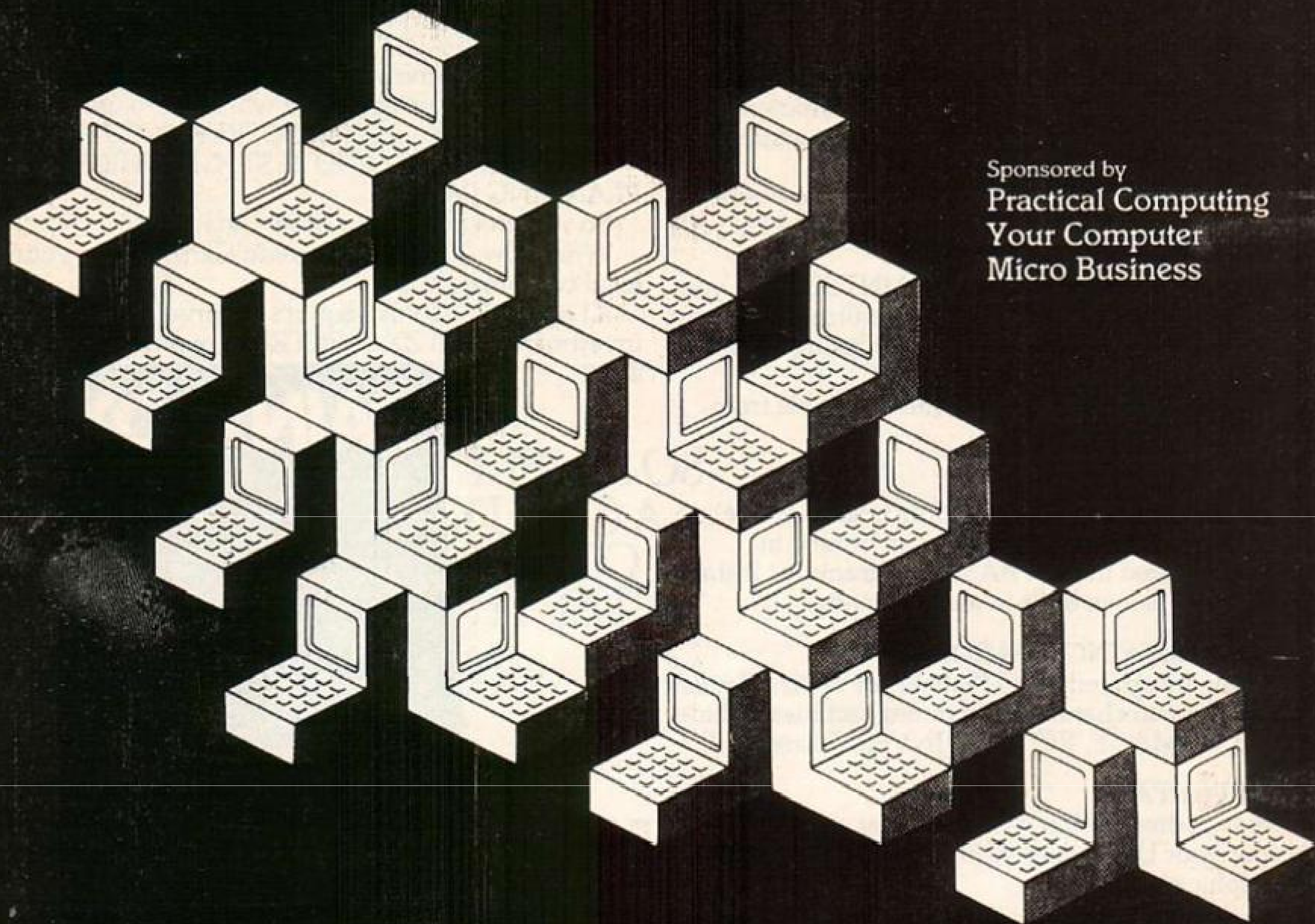

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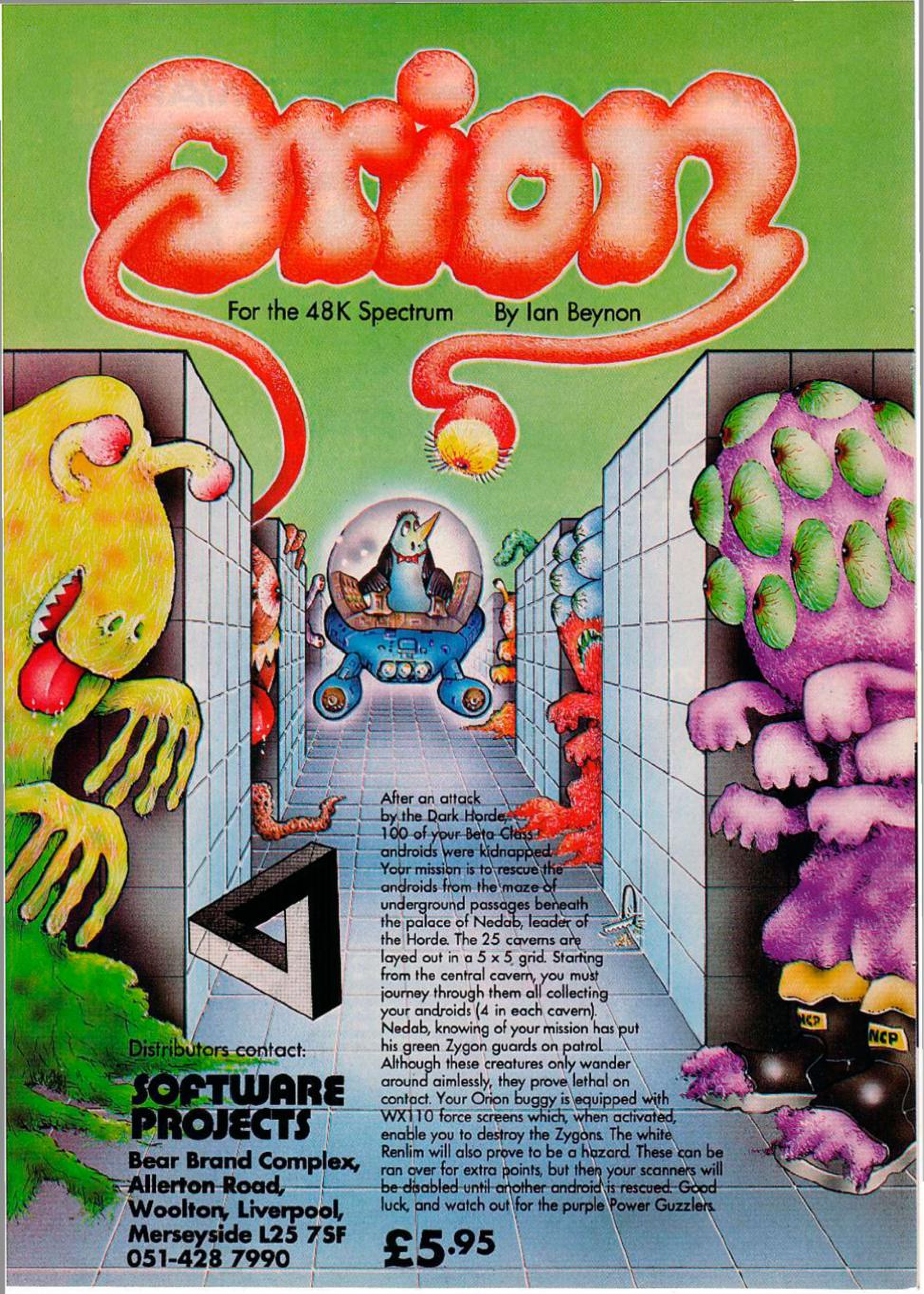
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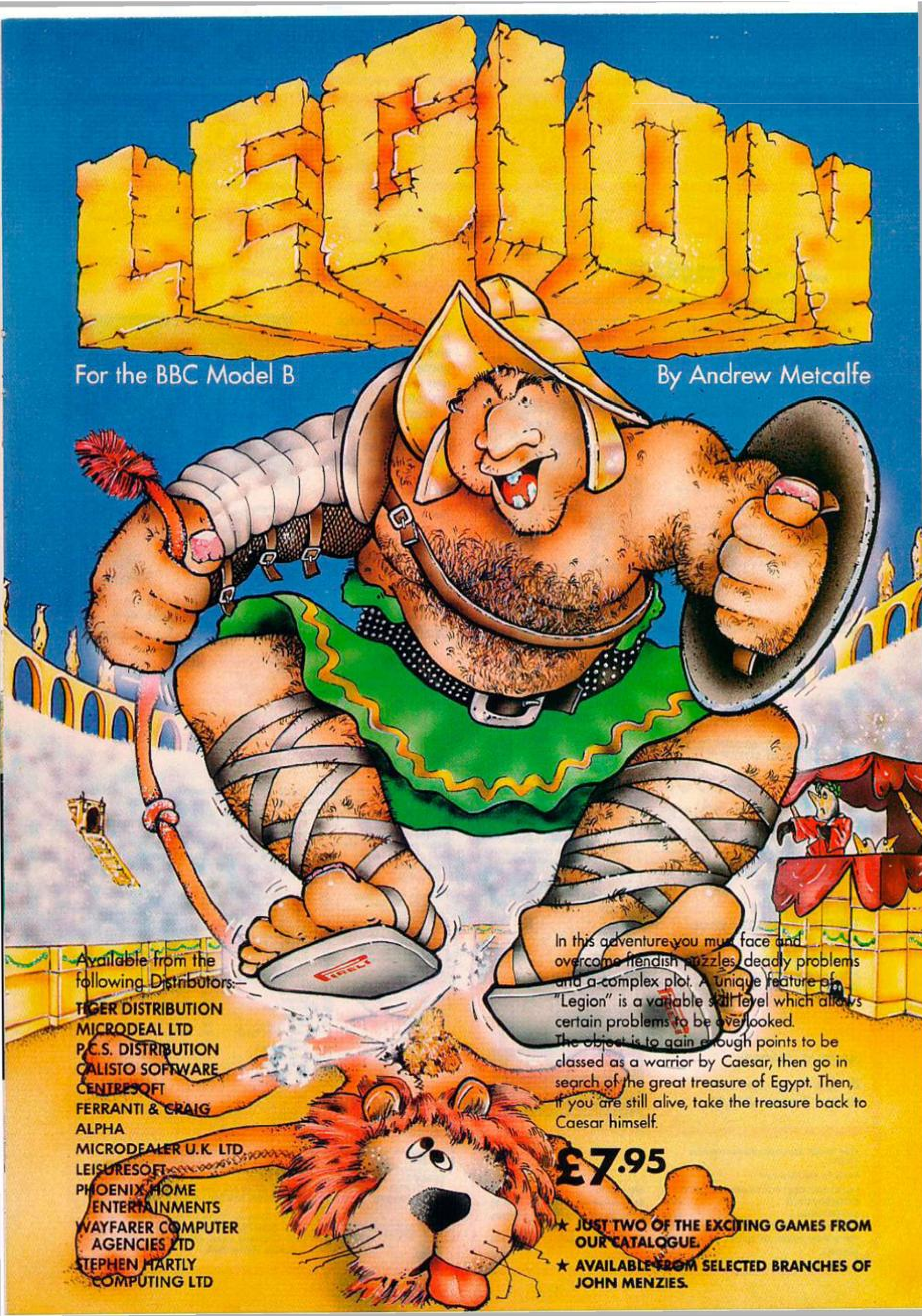
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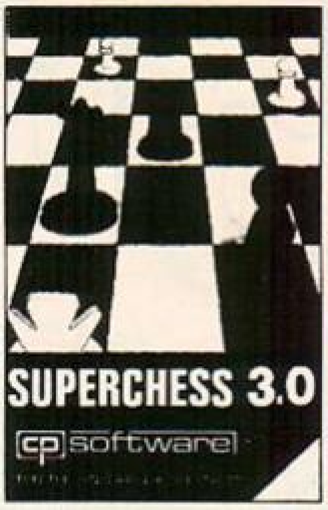

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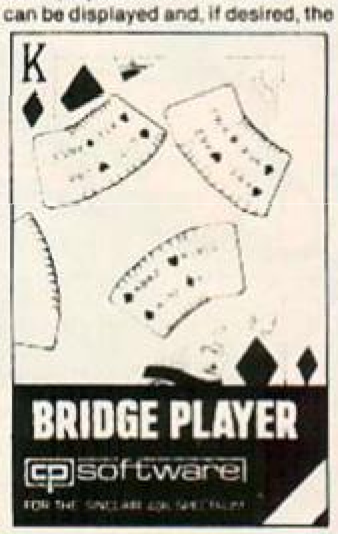

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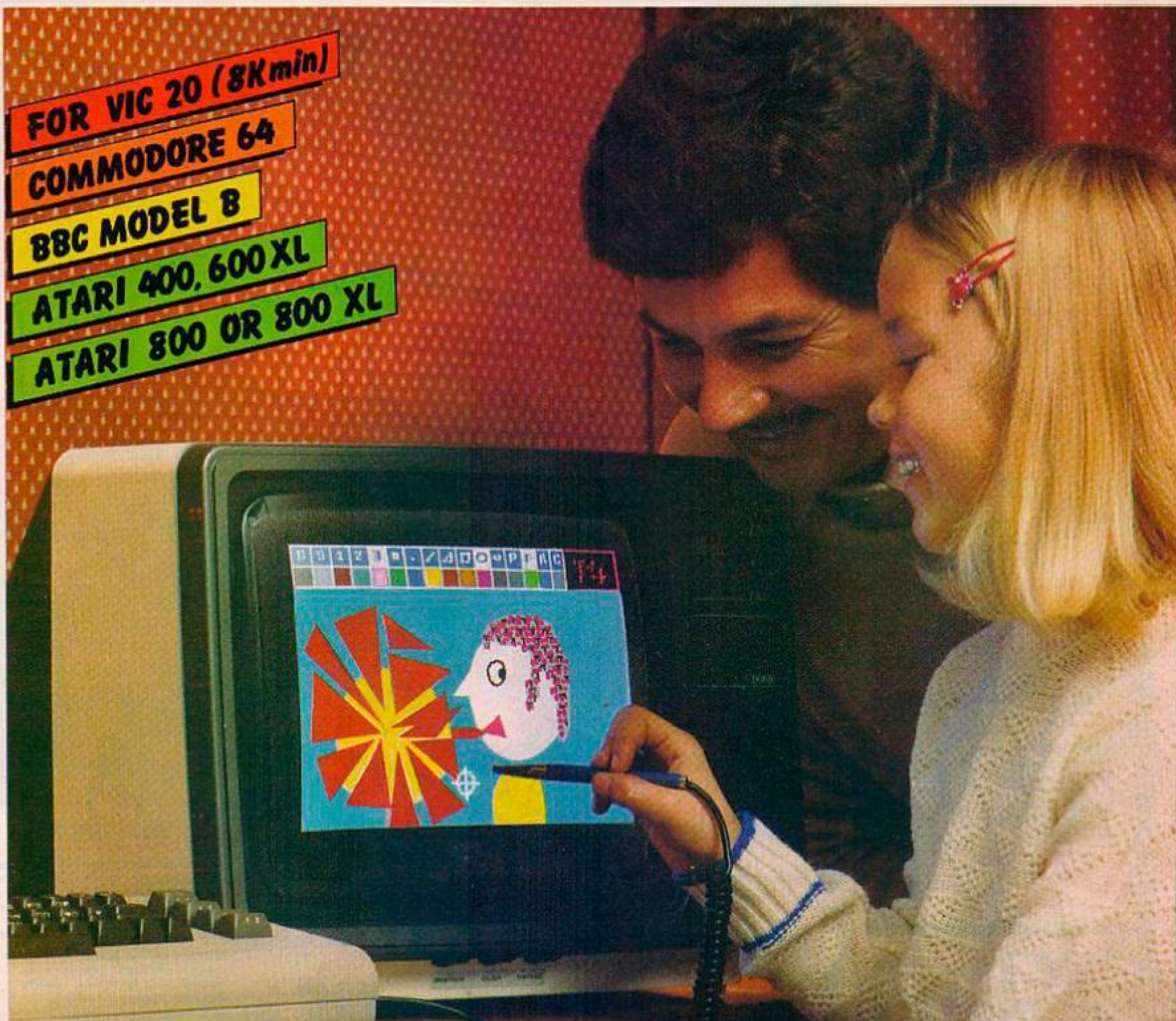

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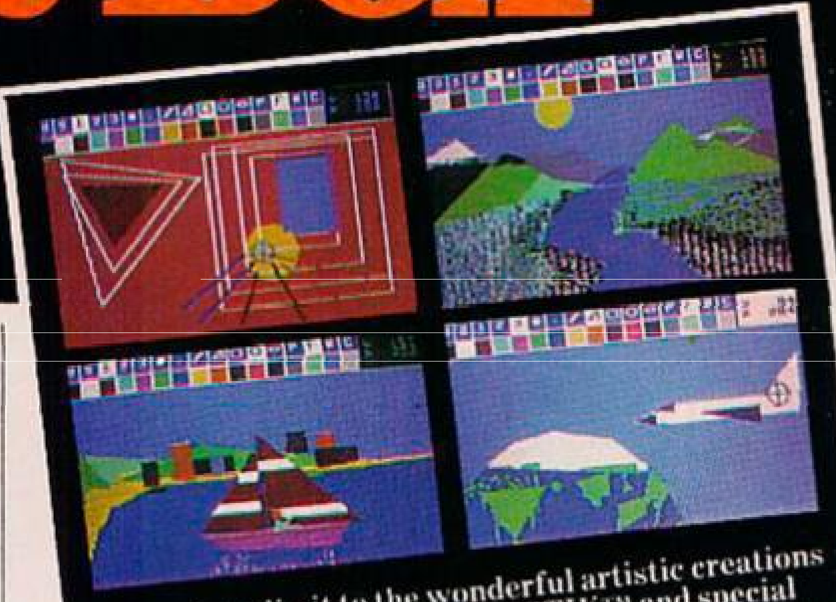

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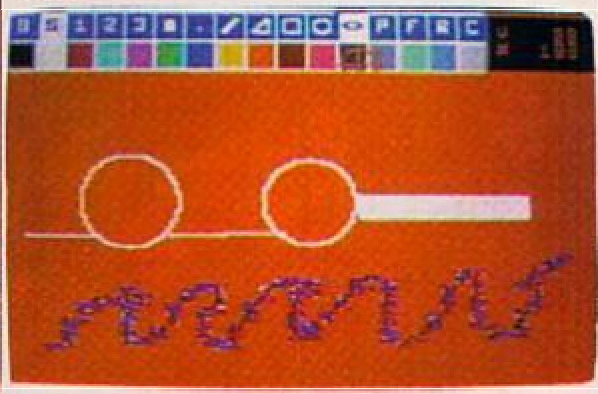

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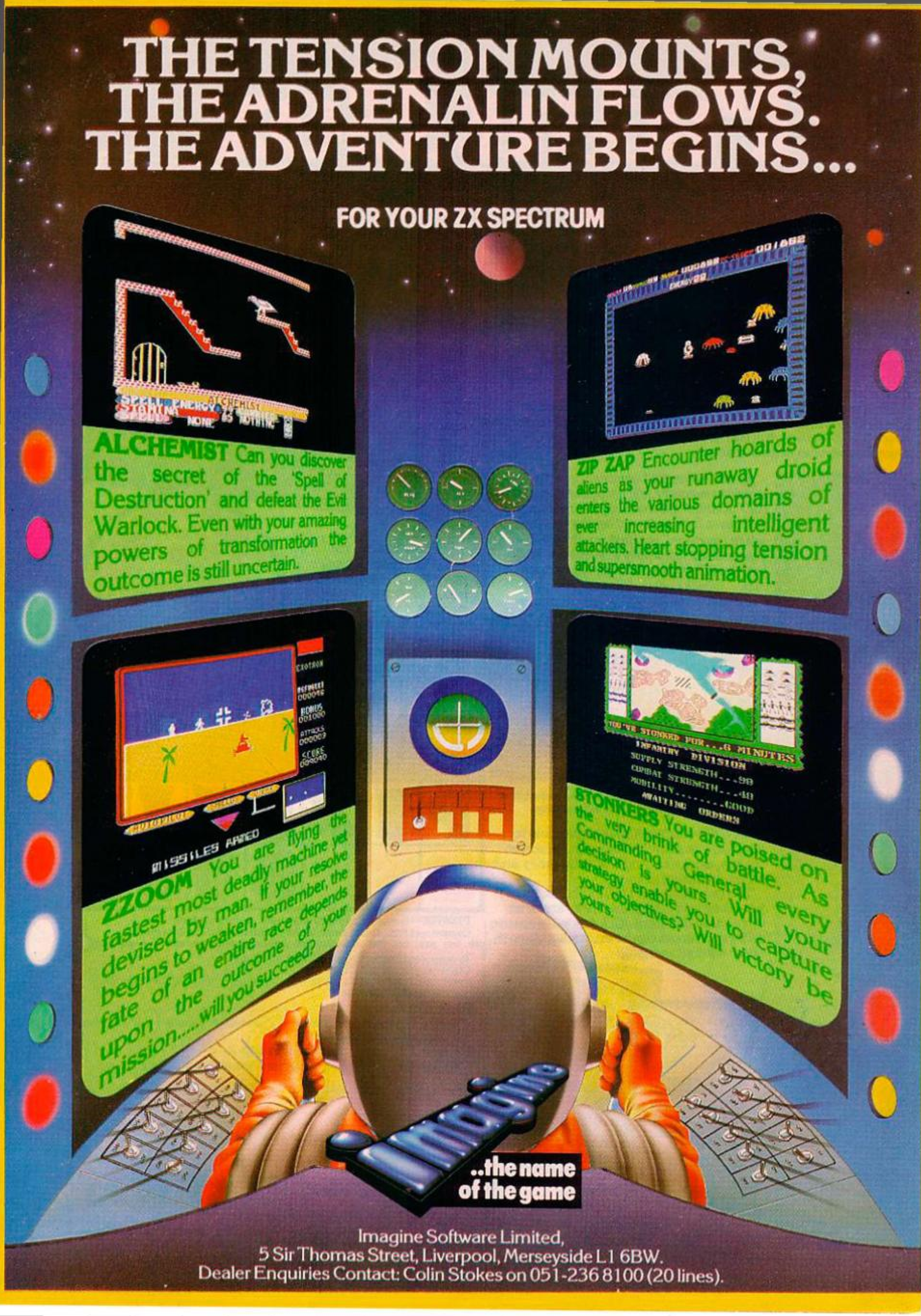

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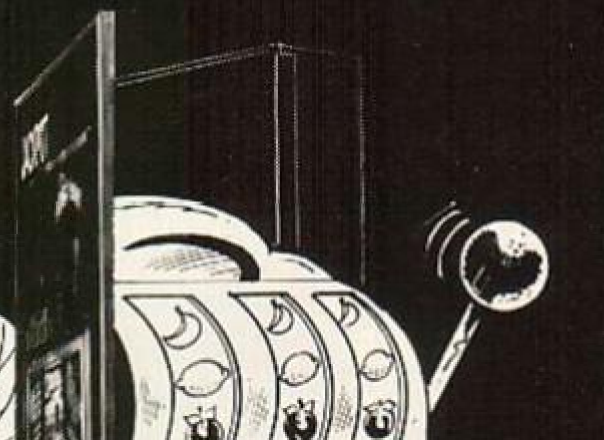

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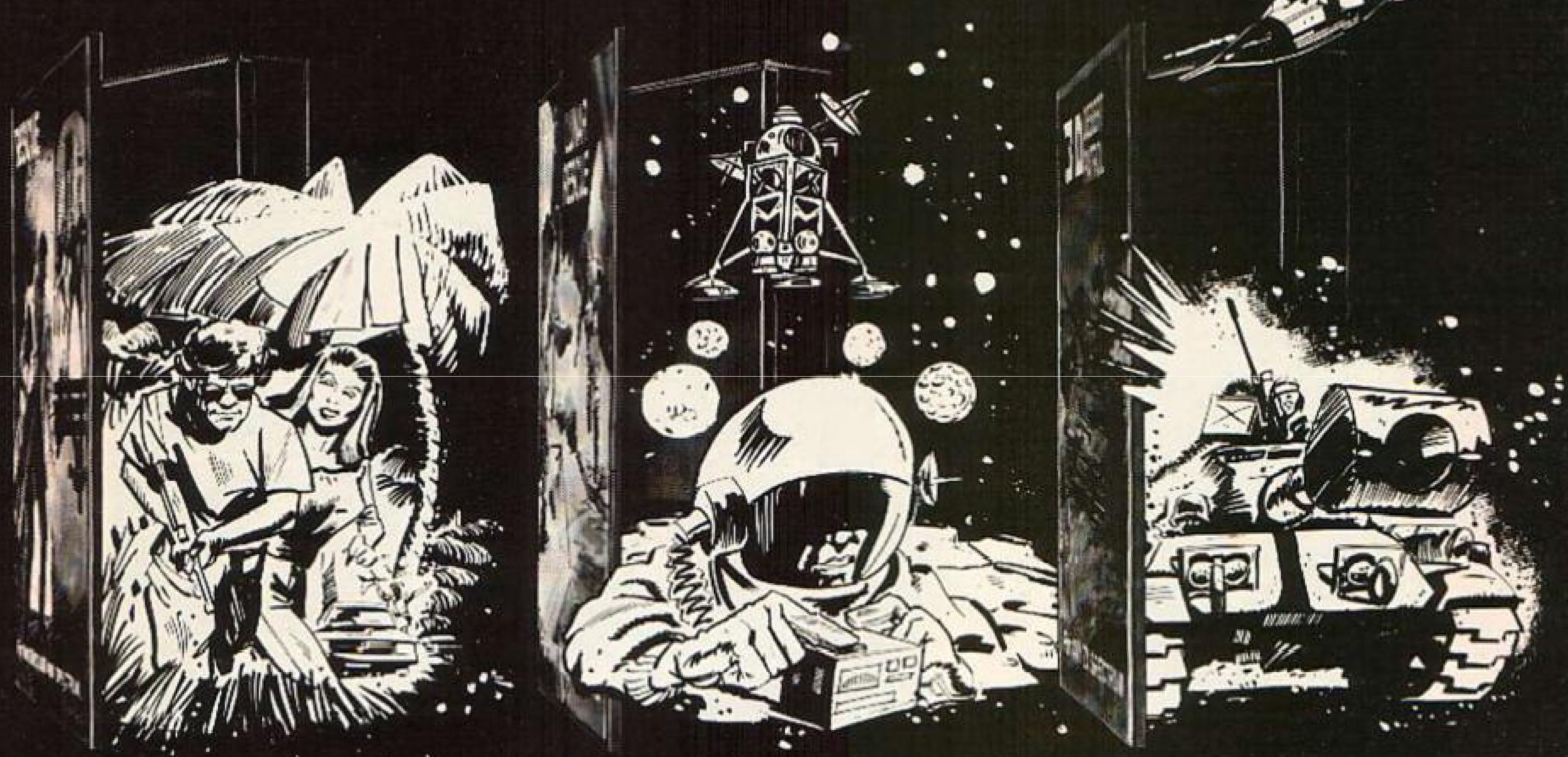

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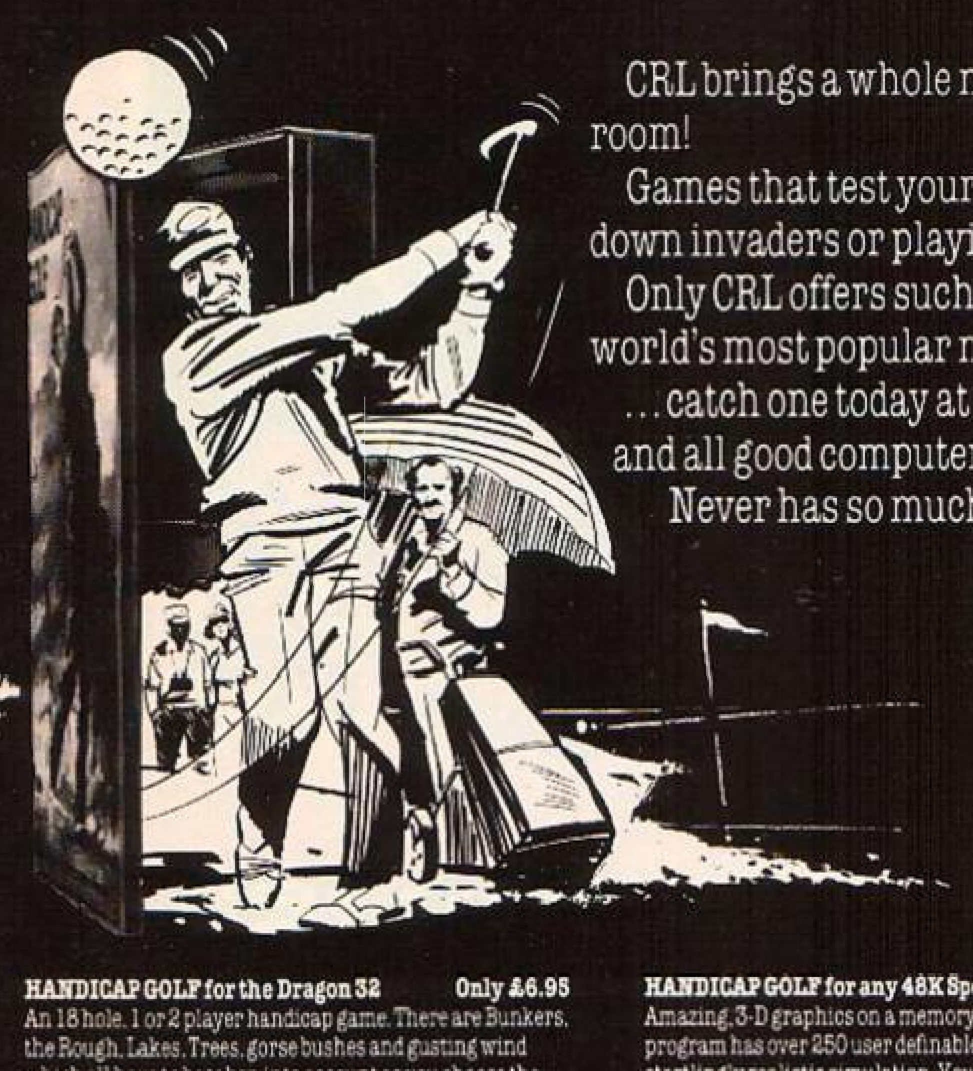

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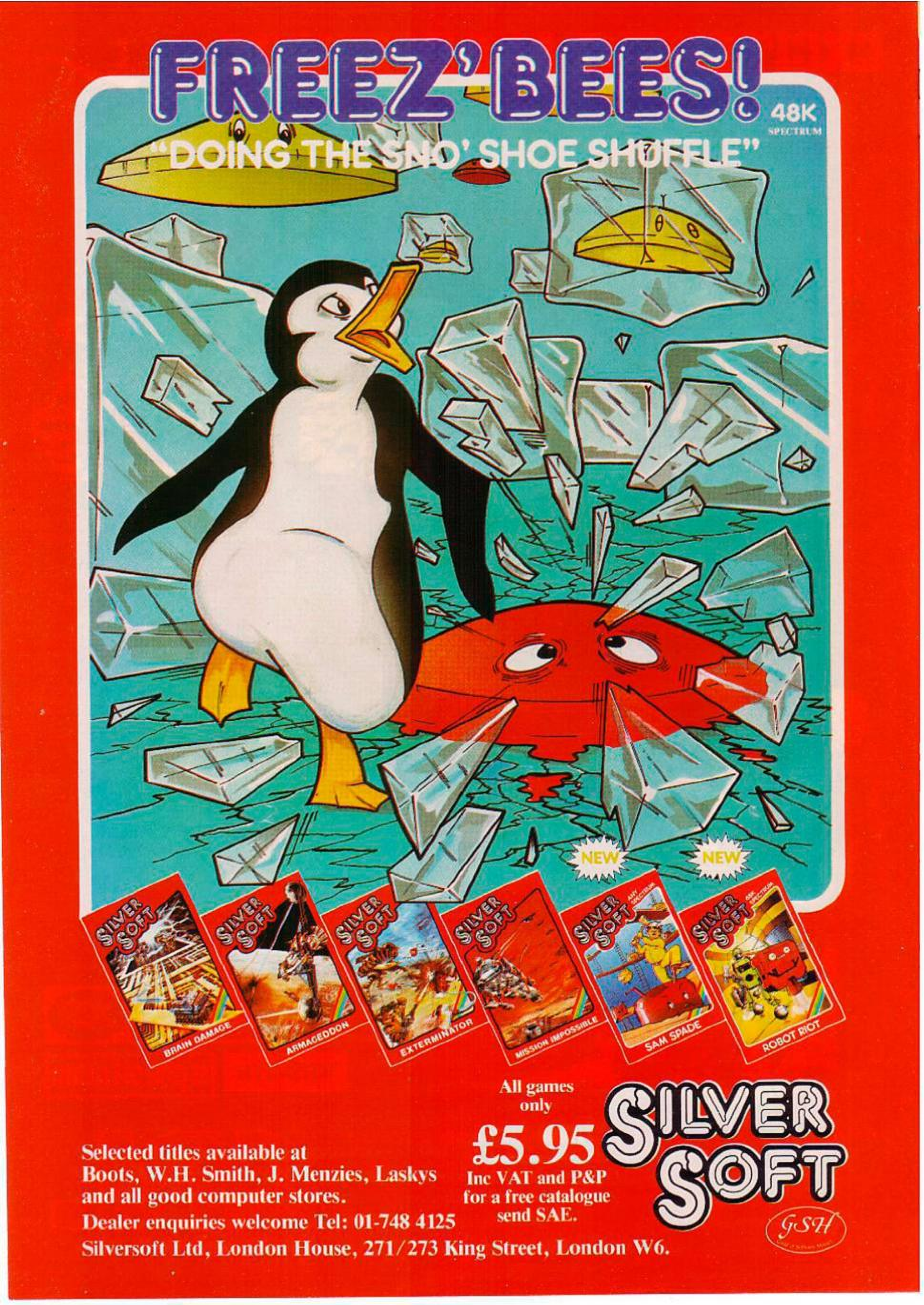

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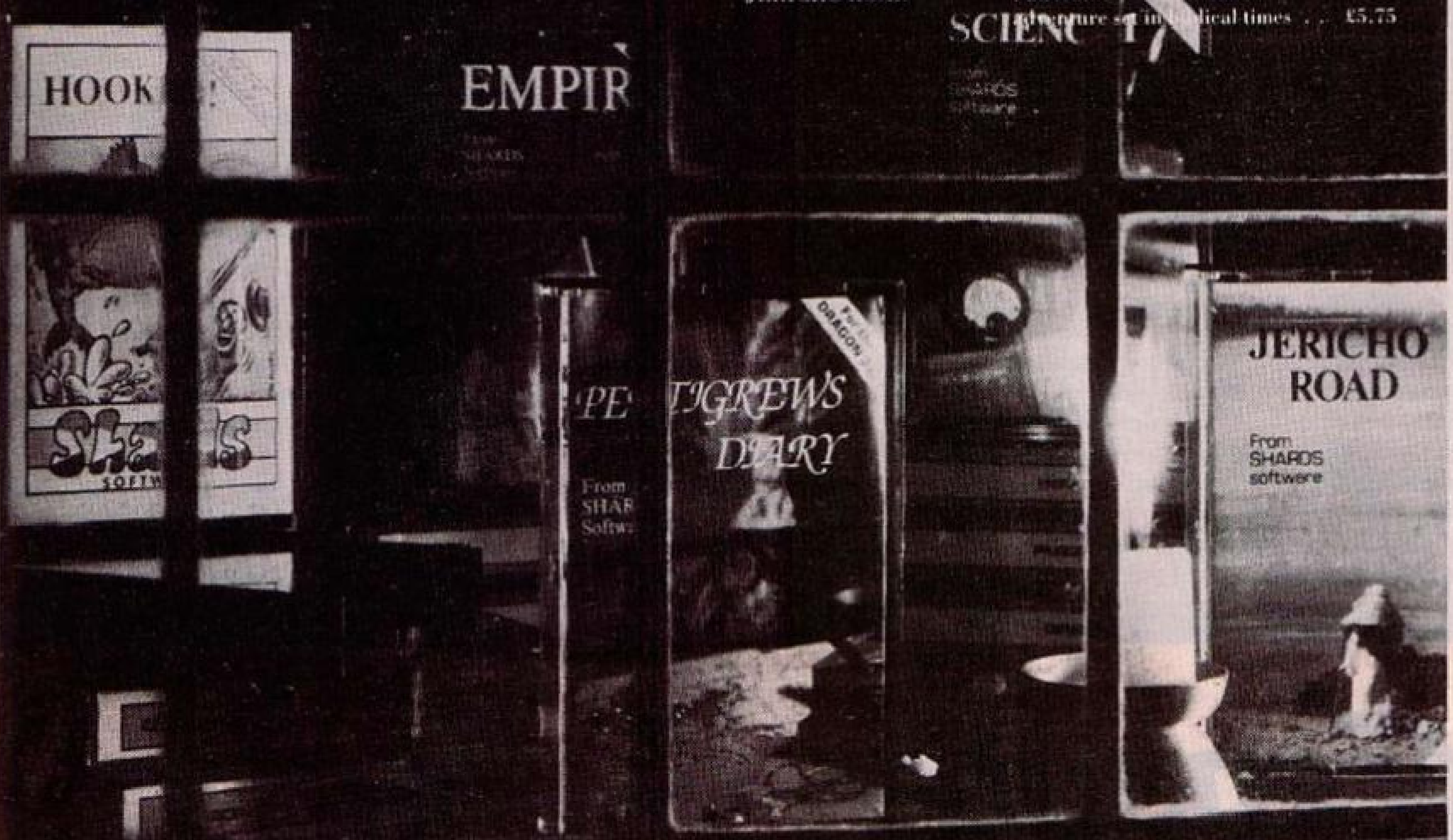

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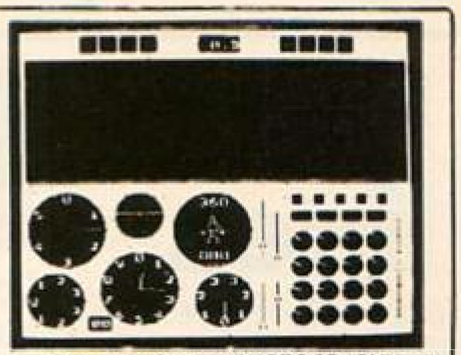

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DATEBASE

Local, national and international micro events are updated here. To publicise your event, phone Paul Bond on 01-661 3472.

Computer Trade Show

This trade-only show at Wembley Conference Centre from 13-15 March is geared at dealers. It is in its second year and has a vast range of exhibitors, both hardware and software-oriented. For more details contact Reed Exhibitions, Surrey House, Throwley Way, Sutton, Surrey, or telephone 01-643 8040.

Scottish Computer Show

Sorry, but there's a lower age of limit of 18 for this business and education-orientated show, which will be held in Glasgow from 13-15 March. The event is split between two venues, the Alderney Hotel, and the Anderston Exhibition Centre. For more information, telephone 061-832-242.

An Octopus computer was recently used in the scoring process for championship skiers on the slopes at Valliore, France. Without its help, the organisers would have been snowed under. Geddit?

London Computer Fair

The Association of London Computer Club's fourth fair is on 19-21 and 23 April at Central Hall, Storeys Gate, Westminster. The ACC clubs database will give enquiring visitors the location of nearby clubs and all the club stands will have workign demonstrations. The show by users for users. All the fun of the fair. Enquiries to 01-930 1612.

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